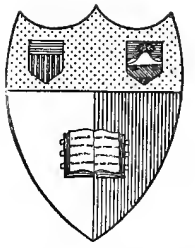


verifiabl

U

Wit

Professor of Philosophy, Columbia University
MORRIS LLEWELLYN COOKE,
Consulting Engineer, Philadelphia

This book solves all problems of why, how, what, in science, religion, and philosophy. Or, it gives an intelligible and unified statement of the fundamentals of all things, and applies that to everyday life. It is addressed to the average educated man, but is designed to meet the requirements of experts in various branches. The book is experimentally verifiable.

Some of the particular things the book does are:-

Establishes a sound logic. The logic used by the ordinary man is right; that used by Aristotle and nearly all books is wrong.

Removes the fundamental error from mathematics, and makes mathematics simple; proves Euclid's "axiom" about parallels, and intelligibly solves the various problems of non-Euclidian and n-dimension space.

Revises and unifies the equations of physics. Completes conventional "theories" of physics—about a dozen,—and makes a somewhat new one that is easier:- vortex whirls.

Shows how gravity works. Shows what is wrong with Newton's law of gravity, and why. Makes Einstein's theory actually intelligible—showing that it is one sort of possible language out of an infinite number of possible valid languages or logics. The book shows that everyday language (Euclid's and Newton's and Christ's) is valid, and the most economical and practical — and uses it.

Shows intelligibly what electricity, light, matter, energy, etc., are. Gives birth, life, death of solar system.

Shows how to get energy out of atoms, etc.

That simple and easy physics is used in the last third of the book to solve qualitatively the more complicated human problems—those of age, growth, death, life, birth, sex, medicine, immortality, good and evil, freedom of will, religious experiences and ethics in general, money, taxes, business principles, value, etc.

Proves that the Constitution is right, and shows what democracy is, and proves that it is right and that all other forms of government and 'legal' law are wrong.

Proves (verifiably, of course) the doctrines of Christ; disproves the essential ones of Paul and theologians.

Extracts from the INTRODUCTIONS:-

Dr. JORDAN, one of the leading scientists of the world, says:- ". . .unique . . . daring . . . successful . . . Mr. Klyce makes no attempt to solve any scientific problem by pure reason, but he would have us make rational use of the knowledge we possess."

Professor DEWEY, by many regarded as the leading living philosopher and logician, says:- ". . .The sincerity and power of the book, and the radical simplicity of its unifying idea give it every claim to a hearing. . . . I hope what has been said may indicate the extraordinary value of Mr. Klyce's work for philosophers, and, in connection with the way in which he applies the formal unification outlined to the mathematical, natural and social sciences, to all persons interested in reducing intellectual obfuscation and confusion. . . . . . .Mr. Klyce's book is remarkable, noteworthy. If experts in various lines shall find his special results as fruitful, as illuminating, as his general treatment of knowledge and technical philosophy has been to me, the remark just made will turn out to be altogether too moderate. Any remark of mine about the value of the book in anticipation of this result will seem intemperately extravagant."

Mr. COOKE, a leading engineer, says:- "The world today needs broad generalizations, but even more it needs counsel as to their application to specific situations. This book fulfils both these requirements in a very special way. For this reason I am recommending it, not as a philosophical treatise, but as a text book with an everyday usefulness for all those who are trying to bring some measure of reasonableness and order and effectiveness into our turbulent industrial life. . . The book as a whole, in spite of its austere mechanics, is not hard reading. This does not mean that there are not places—in fact whole sections—which I made no effort to get and others which I read superficially. But the author has developed quite a knack of using words in not only a precise but a commonly accepted way, so that over a greater part of the journey, a lack of mathematical and scientific training is not an insuperable handicap. . . Of course, if one readily understood and as readily agreed with everything in a book like this, it would be too simple a document to merit much attention. . . . I will be much surprised if to most men a reading of 'Universe' will not make the struggle [of life] a far simpler matter than it usually seems to be."

Set up, printed, and published by
S. KLYCE,
Winchester, Mass.
Publisher's price, to *everybody*:- $2 plus postage
POSTAGE, up to 150 miles from Boston, 7c; to 300, 10c; to 600, 15c; to 1000, 20c; to 1400, 26c; to 1800, 33c; beyond, 38c.
Bookstore price, $3

U N I V E R S E

BY

SCUDDER KLYCE

WITH THREE

INTRODUCTIONS

BY

DAVID STARR JORDAN
Chancellor Emeritus, Stanford University

JOHN DEWEY
Professor of Philosophy, Columbia University

MORRIS LLEWELLYN COOKE
Consulting Engineer, Philadelphia

FIRST EDITION. — 1000 copies. — Printed from type and no plates made: plates can be made by photographic processes later if they are needed.

Set up, printed, and published by
S. KLYCE
Winchester, Massachusetts

Publisher's PRICE to *everybody*, $2 plus postage (Wt. 3 lbs.)
Bookstore price, $3 (see Preface, §F i).

1921

CONTENTS

ERRATA

The errors in this following first list are those which the reader can not readily see at once are errors, and see what is correct. The second error in the list was made only in about half the copies.

§ 42d	line 8	Read stayed instead of stated.
74f	line 32	Equation should be $Density=MI^{-3}$.
76e	line 14	do $c=Q_{me}T$.
89b	line 21	Read Reeve's instead of Reeves's.
96c	line 2	Read chapter instead of section.
98n	line 34	Read or instead of of.
114d	line 3	Read or instead of and.
132a	line 9	Read lower instead of slower.
132e	line 10	Read 1913 instead of 1903.
136c	line 14	Read F instead of the second E.
Footnote 168h-iii	line 37	Read good instead of 2nd poor.
do	-v line 14	Read of instead of in.

This second list is a list of paragraphs in which typographical errors occur that the reader can readily correct for himself if he notices them. In a number of the listed cases I caught the error myself and corrected it before printing all the 1000. —— I know that there are some more-technical errors I haven't listed; and probably there are numbers of errors I haven't found.

§§43cf, 44d, 47h, 49d, 50e, 59ae, 60i, 61a, 63c, running head p. 61, 72d, 74b, 76e, 78a, 80c, 81h, 83e, 84b, 85b, 86cdh, 90c, footnote 98d, 98g, 99ab, 100g, 101b, 104b, 112a, 113c, 116b, 118e, 120ik, 122j, 126bg, 133e, 136c, 144hi, 145c (two), 146k, 147fg, 148b, 149jq, 151a, 153d (two), 155b, 161b, 162fj, footnote 166d, 166nr, 167j, 168dmnp, 170k, footnote 172c, running head p. 233, 175c, 176b, footnote 176d, 176e.

THREE INTRODUCTIONS

FIRST INTRODUCTION

by

JOHN DEWEY

Mr. Klyce has invited me to write some prefatory words for his book. In spite of my technical incompetency in physical sciences and realizing the handicap that imposes upon me, I have gladly consented. For although the argument of the book as a whole must finally stand or fall with the treatment of topics where my lack of knowledge makes it impossible for me to have a real judgment, the sincerity and power of the book, and the radical simplicity of its unifying idea give it every claim to a hearing. And judging from the parts where it is possible for me to follow intelligently, I have a strong presentiment the other parts do not go far wrong in substance:—Mr. Klyce himself makes plenty of allowance for deviations in special points.

Mr. Klyce says somewhere in effect that every reader of this book will have in the end to rewrite it for himself. My introductory remarks can not take any other form than rewriting that portion of Part One which sets forth the fundamental logic—or method—of the book.

He says that the book "unifies or qualitatively solves science, philosophy, and religion." Many cultivated readers will be likely to stop right here. While they tolerate or laud classic philosophers for attempting such unification, they associate, with painfully good reason, contemporary professions of such solutions with pretentious ignorance. To make such a claim is the common sign of the incompetent amateur in philosophy and science. My first rewriting is of this phrase.

Mr. Klyce emphasizes *qualitative* unification. He expressly points out that concrete problems of science and practical life are solved only in living them intelligently. For the word *qualitative*, we may write the word *formal*, and contrast it with material unifications. Then we note that such attempts as are in unenviable repute owe their offensive arrogance to claiming material unification. Every philosopher deals with the problem of formal unification, either positively or negatively.

What is significant in this book is not, then, the claim of unification but the *way* it is worked out. Every reader knows how common are phrases that combine antithetical terms, terms that taken separately oppose each other. Examples of such pairs are:- rest and motion, space and time, matter and energy, potential and actual, analysis and synthesis, one and many, individual and society, common and proper noun, cause and effect, freedom and authority, quantity and quality, prose and poetry, parts and whole, mind and body, flesh and spirit, God and nature, purpose and mechanism, static and dynamic; or upon a slightly more technical plane, discrete and continuous, substance and properties, elements and relations, existence and essence. Now the natural mind, the commonsense mind in the best usage of that ambiguous phrase, is not perplexed by those combinations of opposites. They seem natural, complementary; expression is incomplete without both.

Philosophic reflection begins with an express noting of the opposition between the terms of such pairs. It sets out to reconcile them, to get a qualitative or formal unification. Or it denies the possibility of any unification, and holds that all knowledge since it goes on in such terms as motion *and* rest, space *and* time, is "relative." Or, the apparatus of knowing gets between us and the things to be known. Or it generalizes the pairing off into a rigid dualism of the separate, independent forces, substances, principles. Or, like Hegel, it takes the bull by the horns and declares that all "reality," all "truth" is a union of contradictories.

Now it is a conceivable hypothesis that commonsense is innocent of these contradictions because it always uses the terms with reference in a context, to mark or point out features in a situation, and with no other intent than calling attention to them, either as memoranda for one's self or as guides for another. This supposition does not as yet explain the opposed character of the terms, or why they go in pairs. But it raises another interesting hypothesis. What would be the effect if some one else reflecting on the agencies of pointing and marking forgot their directive use, and took them to *convey* something otherwise than as pointers to observations? May not this explain why the terms are effective in ordinary usage and stumbling blocks to the philosopher?

This last paragraph is one way of rewriting another sentence of his Introductory Remarks which will give offense to some readers:- that the author's method of complete formal solution has to do with a "mere trick of words." Unfortunately, not all readers, or writers, take words as seriously as Mr. Klyce does. He himself points out that a *mere* word is but a passing sound or a patch of ink. What he is doing, as he clearly points out in §2de, is to investigate the fact that knowledge is a statement or expression, and to investigate this fact by the same experimental methods that have hitherto been confined to the things stated or expressed. Now language as a machine of expression or statement is something quite different from a mere trick of words; and in §155 Mr. Klyce vividly depicts the psychology that makes him from time to time resort to such depreciatory phrases. The reader must balance it with the term "absolute unification of science, philosophy, and religion," as he is used to balancing the terms rest and motion, whole and parts.

Let us return then to the hypothesis that in actual use names call attention to features of a situation; that they are tools for directing perception or experimental observations. The first thing to be noted is that the "situation" is referred to only in the (literally) *most general way*, as the limiting including thing within which specific things are pointed out. A gesture calls attention to a dog-fight. It doesn't call attention to the town, to the world or the sun and its light or to the previous history of the animals or to the position and expectations of the observer. And if some special feature within the dog-fight is then pointed out, a broken leg, the fight itself is no longer specified. It takes care of itself. It is now the "situation" as the entire visible scene was formerly the situation within which the fight was discriminated. The *situation* as such in short is taken for granted. *It* is not stated or expressed. It is implicit, not explicit. Yet it supplies meaning to all that is stated, pointed out, named. Its presence makes the difference between sanity and insanity. We may say if we will that it is ignored. But the ignoring is not the ignorance of denial. Ignoring means "understood," assumed as a matter of course as the background and foreground which gives intelligibility and state-ability to what is explicit, expressly pointed out. Now the implicit situation cannot (save arbitrarily; that is, by some agreement for a purpose) be stopped short of Everything. The setting,

the implicit situation, shades off from the explicit, indefinitely and continuously. "Everything" is understood, implied, then as the setting, or meaning-giving force, of what we explicitly say or state.

Recur now to the actual naming or pointing. It discriminates, distinguishes something; makes it explicit, states or expresses it. That which is pointed to gives the meaning of the word or directive gesture. But the *lone* thing pointed at has no meaning. We always distinguish one thing *from* something. All explicit names point out then a comparison-contrast of at least two things. A *This* by itself, as Mr. Klyce points out, has no meaning. It is not an expression or statement, but merely another thing, a noise or figure. *This* explicitly implies *That*; *Here* explicitly implies *There*; *Now*, *Then*. In short, the simplest possible intelligible statement *explicitly* implies a number-of-things-related-together, while it *implicitly* implies a sum total, or an 'Everything' with which the related plurality of things is continuous. This is a "trick" of language just as a watch may be called a trick of steel. It is the only way a thing can be done, in one case keeping time, in another case giving direction to observations of existence. Size and complexity in both cases may vary indefinitely; and substitutes may be found for steel, and different signs in language. But the way, the principle, remains the same. Here is the qualitative or formal unification.

This is one way in which one basic proposition of Mr. Klyce may be rewritten. This way of writing will probably appeal especially to those habituated to philosophical modes of writing. For it suggests that the problem of statement, or language, is identical with what in philosophical writing is called the epistemological problem, the problem of knowledge. Science is the *expression* of experiments with things. It isn't the things over again, nor is it simply the experiments. It is communication of them with their results in consistent form. The simplest and most objective way then to examine knowledge experimentally is to examine consistent expression or statement experimentally—to see what happens when we do or make it. The method as used by Mr. Klyce gets rid of an enormous amount of cumbrous and largely effete psychology. It cuts out an enormous mass of historical reminiscence that obstructs the path of one who approaches the subject in the traditional way. To philosophical readers (to those who use that particular dialect) I would point out the freshness and directness of Mr. Klyce's method of approach to the old problem of the nature of knowledge.

This remark applies to his method irrespective of the results he has obtained by its use. Let us now return to an inspection of these results. In any intelligible statement, from a gesture to a complete discourse on science, there are *two* kinds of implications, one implicit, the other explicit. The explicit implication is that of relations between elements; that is, between distinguished parts. The implicit, understood or taken for granted is, ultimately, as we have seen nothing less than the universe or "Everything."

Now (1) this implicit implication is strictly ineffable. It cannot be stated. For it is required to give meaning to any statement. Yet it is convenient, and for consistent expression of complex matters it is necessary, to have a term to refer to it. It is necessary to have a word which reminds us that whatever we explicitly state has this implicit, unstateable, ineffable implication. Hence the terms which Mr. Klyce calls *One* words, like all, nothing, only, being, every, infinity, universe, whole, never, always. These words have no (definite) meaning. In philosophical terminology they are transcendental, noumenal, a priori. They are religious terms, like God, eternity, perfect rest or peace, complete salvation. An experimental realization of their meaning is had only emotionally, and the emotion may be poetic, esthetic or in some cases mystic. Speaking in philosophical terminology, we have here revealed the truth and the falsity of the whole brood of absolutistic, transcendental philosophers. They have had a genuine experience of *All*, which is required for the meaning of any consistent statement. But they assert that these *One* terms themselves have a meaning; that they are terms *of* statement. Or if they are professional mystics, the ineffable character is recognized, but the experience is regarded as a special, separated, not to say unique, experience, instead of what is implicit, in some degree of intensity, in every experience.

(2) The other side of statement is distinctions-in-relations, *Many* words, and Relationship words. Here the ways of going wrong by failing to observe what we do when we state or express or 'know' are more numerous. The most general and fundamental one is to turn the ignoring of the Everything or Universe (to take Mr. Klyce's favorite term, tho to some it is too indicative of the starry heavens) which is equivalent to its implicit assertion into its explicit denial. This is the root of all kinds of phenomenalism, relativism, agnosticism. For it amounts to asserting that the very act of making known (expressing) mutilates reality, puts a veil or screen between us and reality, hides things-in-themselves from us, perverts it in bringing it within our grasp. This is the root of all agnosticism and subjectivism—the notion that the process of knowing intervenes between us and the things to be known. And Mr. Klyce's examination of Statement shows that this notion is due to failure to grasp *all* that is done when we state; namely, refer to the Whole as the context within which what is explicitly stated falls as constituting its meaning.

Every statement (or knowledge) fully realized in its import or logical form links us up with the Whole, instead of cutting us off from it. And this is true when the statement is materially wrong—as every statement in its explicitness is bound to be in *some* degree. For *some* of its implicit junctions with the Whole may be rendered perceptible in further statements. If the statement is sincerely taken, they not only may but *will* be. Every intelligible statement contains within itself, in other words, the conditions of its own rectification, provided we carry out the experiments it indicates. I think that those who appreciate the force of these remarks and who find them verified in their own experience will agree that Mr. Klyce understates rather than exaggerates the emotional relief and expansion that may come with it.

Other fallacies which arise from failure to perceive fully what happens when we state or make known (to ourselves or others) are materialism and mechanism—as a wholesale 'ism, that is. This arises from observing that parts are discriminated and failing to observe that they are at the same time related. The problem of relations and elements is a familiar one in philosophical writings. Perhaps one need here only call attention to the likeness and unlikeness of Mr. Klyce's treatment with that of Mr. Bradley. The latter also points out that every statement both analyzes and synthesizes, selects or partializes and also unifies. But he places those functions over against each other. Selection mutilates the living fullness of reality. Unification adds as it were insult to injury; it falsifies, for the selected parts are not as such capable of union. They unite only in the whole. From this property of statement (judgment, in Mr. Bradley's language) he infers that everything we judge is compelled to take on the form of appearance, because it involves self-contradiction, and this cannot be found in reality.

All this is suggestive of Mr. Klyce's insistence upon identity or "circular perception" as the test of statement, and

his pointing out of contradiction between the many and the one in every statement. But where Mr. Bradley ends, Mr. Klyce begins. He points out that this contradiction is itself contradicted by the assertion (indication) of the implicit Everything. The elements selected are *so* related in every intelligible statement as to constitute the Whole; or, the situation is *so* distinguished that it has an infinite number of elements. And infinity is again a reference to the Whole. This is the "verbal trick" in its simplest form. The infinite regress of relation and element which Mr. Bradley points out in judgment is to Mr. Bradley another sign that our knowledge does not get beyond Appearance. Mr. Klyce shows that this infinite regress is the method by which every statement indicates or refers to the Whole. It negates the seeming arbitrary selection of some parts by calling attention to the fact that the Whole has an infinite number of other parts: that is, is a whole.[1]

Another fallacy arises from confusing relationship terms with many or one terms. In this case, we get pseudo-idealism, pseudo-intellectualism, abstractionism in the sense which Mr. James so vividly condemned. Mr. Klyce refers as an instance to the fact that many writers dress up the relationship word *truth* in shining armor, and exploit emotions with it. All idealism of the self-conscious, professional type is of this nature; all idealism, that is to say, that opposes the ideal to the actual, and throws contempt upon the actual and concrete; which sets up ideals as something above and too good for the common man in common experience. It is the aristocratic vice par excellence. The ideal is the Whole implicit (tho not implied in the ordinary logical sense of implication) as the meaning of *every* intelligible experience. Hegel doubtless saw this in a way, but made the typical idealistic error of supposing that the task of philosophy was to derive modes of statement superior in kind to those of commonsense and science in which the implicit whole should be rationally explicated. In fact, the philosopher has the humbler task of pointing to the fact that every consistent statement already refers to an ineffable whole. Realism, especially modern analytic realism, on the other hand, ignores entirely the implicit, and insists only upon logical implications; that is, relationships which can be made explicit. As a consequence its relations become only another and strange kind of things or parts. An atomism results which taken strictly forbids all statement whatever—as the Greek critics of a similar view long ago pointed out.

A word may be added on Mr. Klyce's elimination of the bugaboo of subjectivism. Mr. Klyce gets rid of it by starting with expression or statement as itself an objective fact which can be observed like any other event. His method may be said to assume or imply that expression is a 'function' of things just as heat is. But this assumption is, as Mr. Klyce points out, merely formal in both cases. The *meaning* of the "assumption" that heat or a statement is there (is happening) is not found *in* the statement about heat or expression but in the observation of the happening itself. A finger-board on the road does not materially assume anything about the town to which it points. It actually or materially does nothing but point. The only "assumption" is that *if* you take the road you will find——what you will find; that which you find is alone the real meaning of the sign-board. The sign may lie; Mr. Klyce may be mistaken. But the only way to find out either thing is to take the path indicated. In the case of the book this means to observe, with the guidance of its author, the thing or happening called expression. It takes a considerable amount of skill and a large degree of vision and good will to follow the road, but that is all.

[1]In rewriting one part of Mr. Klyce from the standpoint of the traditional problems of the theory of knowledge, I am doing him an injustice not only from the standpoint of the larger public not concerned with technical philosophy but from the standpoint of professional philosophers. For reference to the positive development of implications of space, time, energy, units of science, and the formulae for their relations, in which Mr. Klyce makes his formal unification fruitful is omitted.

I hope what has been said may indicate the extraordinary value of Mr. Klyce's work for philosophers, and, in connection with the way in which he applies the formal unification outlined to the mathematical, natural and social sciences, to all persons interested in reducing intellectual obfuscation and confusion. Many thinkers have had the laudable ambition of exhibiting the connection of science and philosophy with commonsense. But usually they have taken commonsense to mean a mixture of the operation of sound sense with a body of inherited engrained traditions and sophistications. Mr. Klyce has taken commonsense in its radical and simplest form, the form of stating or making anything known. He has himself pointed out the reason why his thought is not always easy to follow. The most difficult thing in the world to learn to see is the obvious, the familiar, the universally taken for granted. Taken as a sketch of a certain way of discovering the meaning of knowledge in general and in its typical branches, Mr. Klyce's book is remarkable, noteworthy. If experts in various lines shall find his special results as fruitful, as illuminating, as his general treatment of knowledge and technical philosophy has been to me, the remark just made will turn out to be altogether too moderate. Any remark of mine about the value of the book in anticipation of this result will seem intemperately extravagent. After the result, it will, fortunately, be quite unnecessary.

JOHN DEWEY.

SECOND INTRODUCTION

by

DAVID STARR JORDAN

The unique treatise for which I have been asked to write a few words in introduction impresses me as a daring and successful effort to aid straight thinking by the accurate use of language. Its central purpose is to bring into the realm of Science the philosophical conception that all that exists is in a sense of one piece,—infinite variety embraced within infinite unity. Thus the Universe may be looked on as a majestic Federation of Energies, an infinite machine in which all parts fit and cooperate.

Oneness, however, does not imply tangible sameness, though some apostles of Monism have insisted that underlying unity inevitably postulates at least some measure of objective identity—as of matter and force, for example,—or more concretely, of all the chemical elements, one with another. But to be fundamentally "at one" does not necessitate any such sameness. Matter and force must complement each other, in some positive sense, as the key fits the lock. Indeed there are numberless intimate relations which do not necessarily involve identity of origin, form and substance. In a harmonious universe (however we may describe it) there might be (and we can know only by observing) a million definitely distinct chemical elements, not interchangeable and not derived from Haeckel's fancied "Protyl," or any other primitive world stuff, whether matter or spirit. As to this and to all other questions of fact, we shall never know the answer until we find it out by looking. Moreover, the conception of the unity of the Universe need not ever

reduce it to a single substance, nor even to a single definite purpose. Pluralism (multiplicity in unity) is as true as oneness, in the meaning given by William James's assertion:- "No one can question that the Universe is in some sense one, but the whole point lies in what that one is."

Science is human experience tested and set in order; any belief which neither demands nor permits verification lies outside of Science. All propositions which can be proved by deduction or even proved completely (see §35 of the book), belong to the realm of expression or Logic, not to Science,—conclusions being involved in premises. Pure mathematics, for instance, is the logic of number and space, and its demonstrations, however intricate, are derived from its definitions. Similarly, a definition of the Universe can be framed in such a way as to make its unity self-evident;—in fact no other definition that is self-consistent is possible: but no scientific conclusion can be deduced from proof thus obtained. Details of reality—matter, force and life—would be no nearer demonstration than before, for these we know only from the coordinated results of human dealings with them.

Knowledge, never complete, may be relatively exact or inexact according to the sufficiency of our data. In no field has Science yet reached completion,—and it is in the nature of things impossible that it ever can. It sees some things very definitely; but the unknown lies as a trackless wilderness on every hand. As details accumulate, generalizations are possible—and even prophecy with some degree of certainty. In Physics, Chemistry, Astronomy, relative exactness prevails. The simpler the factors involved, the more definite our mastery. Obstacles in the relatively exact sciences are mainly our human limitations. The enormously distant and the extremely small elude precise observations; star and electron baffle alike; the bulk of the Universe is beyond our definite seeing. "Time is as long as space is wide," and no one can conceive a limit to either.

The sciences concerned with life deal also with the elements of matter and force, but in highly varying relations. In any biological problem, conditions due to the relative position and relation of atoms and molecules, of cells and tissues, of organisms and environment, are visibly varied almost to infinity; data of one sort or another everywhere abound, but the more we have, the more we see we need. Untested problems crowd on every solution. In biology, therefore, to a degree greater than in the more exact sciences we cannot know what we know or what we do not know with completeness or ultimate precision.

The only final test of a supposed fact is found in our ability to prove it by trusting our lives to it, or to the method by which it is gained. Simply to demonstrate that a proposition will "work"—that is, "muddle along" after a fashion—is not enough; in all its parts it must stand a supreme test, that of "liveableness." Such a direct and conclusive proof, however, is not available in all life's complex and immediately pressing situations. The next resource is to test the method behind the conclusion. The aggregate of knowledge, so tested, constitutes Science, which then becomes the guide to conduct, though never infallible, because never complete. In default of personal experimental knowledge as to matters of fact or ideals of conduct we make the best we can of the conclusions of others, trusting to the strength of the method by which the conclusions are reached. We thus have an acceptable hypothesis on which to act until the returns from personal experience begin to come in.

Mr. Klyce makes no attempt to solve any scientific problem by pure reason, but he would have us make rational use of the knowledge we possess. As to the fundamental coordination of all which exists, known or unknown,—any consistent use of the word Universe implicitly asserts it. Man himself is able with fair success to make his way in the Cosmos; obviously then he is not utterly alien. Not only does his continued existence prove him not alien, but furthermore, by taking thought, he can make headway against the forces of nature and thus in some degree shape his own career. A similar line of argument is shown to apply to every concrete thing of which we are cognizant. The burden of disproof of Mr. Klyce's thesis lies on him who, within the confines of the Universe, can conceive anything—matter, spirit, life, space, or time—which lies outside it.

DAVID STARR JORDAN.

Stanford University, California,
March 20, 1920.

THIRD INTRODUCTION

by

MORRIS LLEWELLYN COOKE

The world today needs broad generalizations, but even more it needs counsel as to their application to specific situations. This book fulfils both these requirements in a very special way. For this reason I am recommending it, not as a philosophical treatise, but as a text book with an everyday usefulness for all those who are trying to bring some measure of reasonableness and order and effectiveness into our turbulent industrial life.

Industry is not only still in the making, but it is in its infancy rather than its adolescence. Just as we begin to realize that civilization is dependent on industry for its very existence we have come to see that this same industry is really not related to Life in any vital way. It is a perilous position and no one claims that the path ahead is at all clearly defined. The perpetuity of our institutions seems to depend on whether in a generation or two we can come to have a better understanding of this Juggernaut we have created. For it is daily more apparent that all will not be well in the world until each unit of the structure of industry is sympathetically related to every other and to industry as a whole, and that industry itself must understand in some measure its relation to Ultimate Reality.

Our industry has been very largely a matter of trading. But the barter basis is disappearing with the advance of science. More and more it is the trained engineer or the man with engineering training who holds the key positions in industry and commerce. But Engineering in the past concerned itself very largely with things. Up to a generation ago engineers were for the most part either designers or constructors of things, i. e., bridges, dams, railroads, power plants, etc. Then the operation of these agencies began to be included within the scope of Engineering. Only quite recently has it come to be considered that in the operation of most industrial enterprises the engineering method is apt to be the most effective. Thus has been developed the engineering of men, sometimes called 'human engineering' in contrast with what has been the more technical engineering of materials. This book, from the business man's or engineer's point of view, undertakes to establish a proved and verifiable scientific basis for this new branch of engineering which some people prefer to call 'efficiency engineering.'

The book as a whole, in spite of its austere mechanics, is not hard reading. This does not mean that there are not places—in fact whole sections—which I made no effort to get and others which I read superficially. But the author has developed quite a knack of using words in not only a precise but a commonly accepted way, so that over a greater

part of the journey, a lack of mathematical and scientific training is not an insuperable handicap. The author advises readers—especially at certain places—not to work too hard to get out all the meaning. I dare say that the average reader who will approach the book in this spirit will get about all the author expects anyone to get on first reading and will then be tempted to start all over again.

The reader should be on guard against being unduly stirred by the author's mannerisms. In some of his comments on "theologians and lawyers" for instance it seems to me that he lapses from his general technique of tolerant expression and philosophy. Of course, if one readily understood and as readily agreed with everything in a book like this, it would be too simple a document to merit much attention.

It is altogether impossible to epitomize the conclusions of any such book. But among many pithy phrases which Mr. Klyce has coined, "balanced co-operation" stands out as one having special significance in the industrial field. It means something more than doing unto the other fellow what you would have him do to you. It seems to involve a measure of action and reaction as between units and groups, which will in every instance be conducive to well-being and growth all around. During the War it would frequently have suggested to organized labor the advantage of restraint in pushing wage claims, and at the present moment it should give pause to those employers who tend to push their opposition to labor unions beyond the checking of their obviously untoward tendencies. According to the author, democracy allows or requires that each side to any discussion re-act to the other. This is the exact opposite of the "We have nothing to discuss" or the "Public be damned" attitude.

After all, whether you are king or labor leader, business man or priest, your master decision is as to whether you will be—to use the language of the book—a "dualist and an autocrat" or whether, constantly studying the unity of all modes and expression of life, you will seek through "balanced co-operation" to participate in the execution of purposes and a Purpose not your own.

Mr. Klyce has shown a "capacity for infinite pains" in carrying his main thesis into so many different scientific realms and there seeking to establish its truth. Too frequently we have been asked to take judgments on scientific, religious and philosophical matters from men who having grown up in one group inherit points of view—even prejudices —which would be dissipated by a larger outlook on life.

Vernon Kellogg says that while "The biologist does have a certain positive knowledge of some conditions or factors that do help to determine the course of human life," it is also true that "the course of human life is partly determined by a set of conditions which are, so far, at least, quite outside the special knowledge of the biologist. He can guess and wonder about them, just as other people do, but he has no right to claim that he knows about them." The same remark obviously can profitably be made about any specialist.

Also, to any specialist is apt to come the moment—and and it is one of possible, even soul-racking, disillusionment —when the inadequacy of a narrow slant on life becomes apparent. The more sincere the worker and the more fundamental his work the deeper the yearning to relate the individual effort to the totality of things. The surest way to give dignity to a simple act is to relate it to a purposeful life. The surest way to endow our industrial system with vitality is to scheme it out in harmony with all Life—to make the paying of a wage and the doing of the day's task in some genuine fashion God's service—to link them up with the Ultimate Purpose.

Of course a great industry will only result from the activities of great men. Most industrial leaders impress us as being literally worn out fighting against a flood of isolated facts and ideas. We need the unifying thought of this book. To be effective we need above all to make our lives simple. Men vary in their mental capacity, but it is undoubtedly true that some men with great capacities are not the match for men of ordinary abilities who "see life steadily and see it whole." I will be much surprised if to most men a reading of "Universe" will not make the struggle a far simpler matter than it usually seems to be.

The very familiarity which grows out of usage has afforded in the past in all too generous measure, the authority which we humans require to make us happy in our work and play. But in so many ways—through education, through a heightened individualism, and more immediately through the shake-up of the Great War—the mass of men are questioning all our procedures in a way heretofore unheard of. In the depths of the mines, in the vast silences where the lumberjacks toil, on the seas and in our great manufacturing plants near the centers of population, men are counseling together as never before, on the meaning of life and the meaning of industry and the relation of one to the other.

The idea that anyone knows in the old particularistic sense is gone. Have we not read only yesterday of Einstein and that theory of relativity that "upsets" one of the surest rocks on which our whole structure of knowledge has been built? We know now as never before perhaps that, to use the language of this book, "There is no exact science." And yet our respect for science deepens and our sense of dependence upon it has become altogether profound. This understanding of the place of science in industry and life is no longer confined to the schools. The nations begin to appreciate the hopelessness of preserving their identity except through science. The owners of our industries perhaps feebly —but altogether definitely—are studying in myriad ways the application of science to the production of goods. And now we detect the first beginnings of the same tendency in the organization through which labor expresses its purposes. Herein lies one of the great bopes of the race. When our workers reach the point where they can well abandon force and embrace science, humanity will be in for a new experience.

But a science that is unrelated is even more fearsome than an industry that is detached from life. Hence our obligation to the author for a master generalization in which science is made to seem but another manifestation of that Ultimate Reality to which the human spirit itself is kinsman.

MORRIS LLEWELLYN COOKE.

PREFACE

§A. *Subject matter.* — a. This book unifies or qualitatively solves science, religion, and philosophy—basing everything on experimental, verifiable evidence. The explicit meaning of that statement is given in Chapters I and II. No assumption is made (as is shown in §22).

b. The book is a condensed, preliminary rough draft of that unification of knowledge. All the qualitative problems set forth by the race—by "religion, science, and philosophy" —are herein positively, definitely, and verifiably solved. But the application of those solutions consists of quantitative

problems; and it is shown that *no* quantitative solution may be *accurately* expressed or given (§§25, 40-1, 50, etc.); also, such solutions are infinite in "number" and may not be even roughly expressed in a finite book. Hence, merely general methods of the application of qualitative solutions to the problems of *how much?* and *how many?* are given. And only in so far as the reader is able to understand, verify, and apply those methods to *his* life has the book any value to him. As each person differs from others (§§162i-j, 167m, 168p, 170p), the best book for one reader truistically can not be the best for another. So this book can not possibly be final, or the last word; other men can continually rewrite it better, wholly or in part. And most emphatically, I propose to no reader any creed, or "theory," or "system" of truth, or ritual of any sort. As will be seen (Part One), all such are merely passing conveniences, tricks with words—and each reader may best select his own words.

c. The prime purpose of the book is to substitute positive knowledge for that aggressive ignorance which is named agnosticism—thus eliminating agnosticism, the current prevailing "ism." The accomplishment of that purpose results in raising the standard and content of living—gives "life more abundantly" (Chapter XVIII, on ethics).

§B. *To whom addressed.* — a. The book is addressed to the general reader who has a fair education. Each subject is treated with the rigor that will, it is hoped, satisfy the experts in that subject. But because the book includes all branches of knowledge, probably no one of the present day would be competent to read it if it were written in highly technical terms, and gave the minute details of each branch. I certainly should not be. So in order to satisfy all the experts by giving each the complete grasp of his subject which truistically includes knowledge of its relations with the subjects of other experts, it was necessary to avoid all but fairly common technical terms, and to omit unnecessary details. And that is equivalent to addressing the general reader.

b. That reader, as will be shown implicitly throughout Parts One and Three, is quite competent to judge the validity of this book. There is nothing esoteric or "hard" about the book in general. It is merely a description of things as they are. However, it requires some work to read the book. Some effort of attention will have to be made in places.

c. A competent scientist of wide and successful experience in writing for the general reader tells me that people tend to be frightened away from a book that uses mathematical equations. I show that such a distrust and dislike of mathematics is justified, and an evidence of the wisdom of people in general: conventional mathematics contains fundamental errors (§§30, 43-4). I remove those disabilities of conventional mathematics, and then use a few algebraic equations which even the non-mathematical reader will nearly surely approve, so obviously do they economize his attention. —— I may add that the publishers I tried seem to disagree with that: the reader may judge whether they underrate him.

§C. a. There is no originality in this book in any real or important sense. Possibly some combinations of ideas are partly new. But I myself have definitely found nearly all, even of the wider combinations, previously advanced by others.

b. Consequently, the reader need not anticipate being repelled by any novelty or heresy of any importance; even when at first there is some slightly distressing apparent novelty, in the end it will turn out to be obviously an old belief. E. g., it is shown that the earth is cold inside (§122i). That does not happen to be the current conventional belief. But it was a common view in the past; and if the reader will examine his views he will probably find that he has no more real love for a hot inside than for a cold inside—but prefers, as the important thing, the actual facts and the absence of self-contradictory views. The perspicacious reader will soon discover that I am very conservative—avoid being either radical or reactionary.

c. As there is no real originality in the book it follows that I am indebted to others for the ideas set forth. I gratefully acknowledge that debt; but those creditors are so numerous that I can name none without injustice to many whose names I do not even know. In even greater measure I am indebted, not only for ideas I have used, but for what is more, personal aid and inspiration, to my wife, Laura Kent Klyce, and to Frederick W. Taylor, David Starr Jordan, John Dewey, T. W. Richards, Dorothy Canfield Fisher, J. J. Thomson, and Gerald Stanley Lee.

§D. a. Some personal remarks may interest the reader, and will give needed information:-

b. In the early summer of 1914 I finished a book that contained substantially what this one does. It was too long, and contained literary defects quite too atrocious, for publication. It ran to about 700,000 words. Since then I have written it over in whole or part continually—having much of that competently criticized. That work is here condensed into a volume of reasonable size—I have struggled to keep it down to 250,000 words (it has expanded in two rewritings and probably will be about 325,000 when I finish setting it up: this page is done in the middle of that job). That almost violent compression of such an obviously extensive subject was necessary chiefly because a long book in this day of many good books frightens away readers, and because with a subject of such a nature a long book would tend to have 'so many trees that it would hide the forest' from the view of the few who might have braved its length.

c. The reader can of course understand that it would have given easier reading if some of the book had been expanded into smaller and more familiar detail. But the almost imperative need of brevity, which has just been pointed out, has required the sacrifice of such ease. Quite possibly no reader will be satisfied with the actual compromise that has been made between such brevity and such local easy intelligibility. The most difficult thing about the actual writing of the book was to make that needed compromise in a way that was even tolerable to the reader—to conserve both his effort of attention and of memory.

§E. *Typographical and similar formalities.* — a. Certain arbitrary printing styles, which are not always used, have been followed in this book. An explicit statement of them here, if the reader keeps the statement casually in mind, will save his attention.

b. The argument unifies knowledge. Consistently with that idea, often when I have a formally plural subject, in my view it is clearly unified, and I use a singular verb—sometimes oddly. Always in that as well as in other grammatical constructions, I try to be conventional and hence inoffensive. But when explicitness and clearness of expression seem*s* to require it, I deliberately sacrifice formal grammar.

c. All names of books, articles, etc., are put in quotation marks.

d. All algebraic symbols are given in italics.

e. All words, used *as words*, are printed in italics; no quotation marks are placed around them unless the custom for such marks (stated in the next paragraph) also applies to them. Italics are also used for emphasizing a word or words whenever it seems to me to make the text the least bit easier to read. It would of course always be possible, by ingenious literary circumlocutions, surely to indicate the desired emphasis without that mechanical use of italics. But the keen reader will appreciate the brevity secured by italics, and will

readily perceive that I compliment him by taking it that he does not need the literary flattery I could give him by letting him waste energy finding the emphasis. This is not a book for stupid readers, who require even literary flattery.

f. Quotations of others are marked thus:- " ", etc.—in the usual way. Quotations of myself are marked thus:- ' '; and such 'quotation' usually consists of my use of some word or phrase in a temporarily unusual sense. The " " marks are similarly used at times to emphasize or indicate that I am using a word or phrase quite conventionally.

g. This double mark :- is used "to introduce something that the previous sentence or clause has definitely prepared for and led up to," so that it just precedes some remarks that are to be expected. The ordinary colon : is reserved for its other ordinary uses. When the :- is followed by a word beginning with a small letter, it introduces merely the remainder of the same sentence—when by a capital not otherwise needed, the remainder of the paragraph, etc.

h. Economy of attention requires the conventional mechanical device of treating a single topic in a "paragraph." Sometimes in this book such a natural topic needs a lengthy paragraph which of itself contains sub-topics. If the long paragraph were split into paragraphs to indicate its natural subdivisions, it would, mechanically, at first give the reader the erroneous and confusing idea that the chief topic changed. So I split it into 'little paragraphs' by a dash ——.

i. Most algebraic 'symbols' used in this book are conventional initial letters; but some are whole words. A list of those symbols, etc., is given as Appendix A. —— The chemical elements and periodic table are given as App. B.

j. The symbol ... will be reserved for the single meaning:- a continuing series, or infinite regress (§36n). An omission in a quotation, which often is indicated by that symbol, is indicated by ***.

k. When I needed to state the source of a quotation or idea, or to indicate where fuller or analogous expression or proof is given in this book, I have tried to avoid that distracting and chopping up of the reader's attention which would have resulted from putting the reference in a footnote in the more usual way, by putting it directly in the text in an abbreviated form, where the eye can recognize it at once for just what it is, and yet inattentively slide over it unless it is to be definitely used. For similar reasons I have tried to get along without footnotes. Only when a needed parenthetical statement seemed to make too violent a break if printed in the text, have I put it as a footnote.

l. In preparing to set up this book myself I read several books on typographical rules and practices. Then I followed that practice which I thought would least intrude itself upon the attention of the usual reader, and at the same time would cost him the least money. When there were two ways, apparently equally good, I have used both ways—that giving variety which I trust will please the reader as much as it did me, and relief from remembering arbitrary rules, and a trial of different ways to see if some actual preference develops.

§F. a. The reader may be interested in remarks on the form of this book and the reasons for printing it myself:-

b. I finished what may perhaps be called the present version in the spring of 1919 (it has been twice rewritten since), and started to look for a publisher. I quickly found that publishers were, so far as I could tell, afraid to risk anything on their judgment of the soundness of the book. So I proceeded to get introductions by leading authorities in the three main sorts of knowledge to vouch for its soundness.

c. While continuing trying publishers I tried a number of endowed institutions and similar organizations formed for the purpose of advancing knowledge in one way or another, to see if they would help get the book published. So far as I could judge from their evasive but usually verbally cordial letters, they believed the book couldn't be sound—not one would even look at a manuscript. There was one illuminating exception. I began corresponding with R. S. Woodward, a scientist then president of the Carnegie Institution of Washington, in December, 1919, and continued until he ceased to be president over a year later. Woodward made a speech to the Congress of Arts and Sciences (convened at the St. Louis exposition in 1904 to try to unify knowledge—spending about $137,000 in the attempt), on the first page of which he said in effect that a book like this is practically impossible. He steadily, with a few exceptions in which he tried safely to dodge my introductions by men with reputations of the highest, asserted in effect that he didn't believe I had a sound book; and steadily refused even to look at it. He repeatedly referred me to his remarks on writers of what he in effect claimed were similar books (in the Year Book, 1917, of his Institution, 21-7), which include these epithets:- cranks, quacks, aliens, charlatans, mountebanks, arrogance, audacity pushed to the extreme of mendacity [that's a nice phrase]. I began to think, after reading his letters, that if my book was sound it must have extraordinary value. But on second thought I decided that more likely Woodward was a little timid in the presence of an idea.

d. I of course went over Woodward's head to the Trustees of his Institution twice. As soon as Merriam took on its presidency the first of this year, I renewed my request to him and he asked for a manuscript, and for months examined it and had some of his colleagues examine it. After I found I would have to wait for a decision I began to print the book myself (see next par.), and asked the Institution to buy 350 copies for distribution to the libraries on its free list. They are still deliberating on the matter.

e. I tried 18 publishers, and they were afraid to take the commercial risk. It is a common practice for authors of books to take the money risk. So I finally had a reliable publisher give me his lowest offer:- it was that I pay $10,000 for an edition of 2500—$4 a copy, to sell for at least $6 and probably more (if I had printed 2500 I could have *sold* them for $1.50—and more, still lower). I didn't have $10,000. So I tried to borrow it on substantially a mortgage on the book, from 25 successful business men, they to have the additional satisfaction of helping advance knowledge. About one quarter of them showed genuine interest; and I am pretty sure that two or three would have advanced the money if I had waited until the present low-speed panic (footnote 168h) is over. Those business men recognized at once that I was honest and probably right (Index, "Sizing up men"). But I decided that the book had waited long enough.

f. I spent three days reading about a dozen books on printing—they were fascinatingly easy reading,—and then about four more reading catalogs and looking at printing supplies and talking to printers, and buying the cheapest second-hand plant (new type), and supplies for an edition of 1000. I have tried my hand a little at being a machinist, a plumber, and six or eight other trades, as I had to handle men in those—and at playing golf. And printing is the easiest—and to me more entertaining and gentler exercise than golf. (Of course, my effort was chiefly to print a passable book at the lowest cost; e. g., there are two or three pages printed poorly because I deliberately would not use time waiting for the humidity to drop and hadn't learned how to counteract it satisfactorily; and there are too many typographical errors left in, due to not spending an extra hour on each page.) It took me a week to print the first page (p. 1), although I had picked up a little printing as a boy; the second took three

days. The last half of the book was printed about eight pages a week, and once nine. I could have gone faster if I had not taken plenty of time to revise the book—to think it over and rewrite as I set it up. That revision was the only real work, except I would occasionally use my head a little to overcome obstacles that printers assured me couldn't be overcome. Printing one's own book is the best method of revising it I have found; it gives more time to think over each word, and a very gratifying and useful sense of responsibility—there being no assumed-omniscient editor to rely on. Anybody with sense enough to write a readable book can learn to do passable printing in a week (of course, printing, or any other trade, can be made a fine art, and a lifetime be profitably spent on it; see §166f).

g. These are the costs per copy, estimated fairly closely:- Plant and supplies (net, after selling them at the price tentatively offered), 17 cents; paper, 28c; binding (by a commercial binder), 25c; ink, $1\frac{1}{2}$c; engravings for pictures (they are poor, I having made the mistake of getting them from a high-price firm), 5c; transportation, $2\frac{1}{2}$c; selling expenses, insurance, etc. (circulars, postage, free copies for publicity purposes), 4c. That makes a total of 83c. Then my work costs:- author's royalty at 5 per cent, 10c; publisher's profit, 7c; my labor, at $25 a week, $1.00—making the total of what I get, $1.17, and the total cost of the book, $2.00. —— I have charged labor at about half present printer's pay. Judged by present prices of farm products, that is probably more than a printer is worth. But if a regular publisher had printed the book I would have had to use fully half as much time on it [and five times as much nerve wear and tear] as I did to do the whole work: and by that criterion $25 a week is more than it sounds. And the plant net cost figures out as a depreciation of 70 per cent a year. A regular publisher of course would not have such an extreme depreciation; so he could afford modern machinery, which is supposed to be five or six times faster than the hand methods I had to use. My "overhead" is itemized above, and contains every legitimate item except rent, heat, and light—which would have been less than 2c if I had included it. The supervision and thinking for the job is included in the dollar for labor; it was less than a millionth of the work of writing the book, so I am getting overpaid at that. Books of about the number of words of this nowadays retail around $10.

h. As that $2 is the lowest legitimate price, I had to annoy buyers by adding postage. Few know what zone postage will amount to, and the buyer is frequently consciously irritated by any price which adds postage. But there is a difference of as much as 600 per cent in the zone postage for this book—which makes it scarcely fair to buyers to average it, as the difference amounts to $16\frac{2}{3}$ per cent of the net cost. —— I doubt if there is in fact any such wide divergence as that 600 per cent in actual cost of postal transportation of small packages; if not, then the present rate is unfair, as well as being a nuisance.

i. I find that some readers want to buy their book at a book store. It costs me no more to sell a book to the reader direct than it does to a dealer, and I find it far more interesting and pleasant to deal direct. I first offered the book "by subscription" at $2 and postage, in that conventional way announcing my intention not to sell at any less. If the reader prefers to buy at a book store, I am of course pleased to have him suited; but naturally he should pay the dealer something for his trouble. I am told that usually the dealer adds about 40 per cent of the cost of the book to him, as the price of his services. So as a mere empty form I have put the retail bookstore price at $3: I have no legal control over the dealer's price. At that price the dealer will perhaps get about 40 per cent increase on the cost to him—and incidentally he will get nearly as much for selling the book as I do for labor in selling and making it. Perhaps his service is worth that to the buyer: the buyer can judge that better than I can. —— Of course, if the dealer were doing *me* any appreciable service in selling this book I would sell it to him lower than to others. But there are only 1000 copies, and I do not want them sold to people who have to be urged in any way to buy; and the slight publicity which dealers could give the book would probably be undesirable. And naturally, if the dealer thinks that what he does for the buyer is worth the price, he will be as anxious to tell him the cost as I am, and will be grateful to me for having largely done it for him. And of course, if any dealer really wants the buyer to get satisfactory value for his money, that dealer will be glad to have the buyer accept my price if more satisfactory. So if any dealer objects to anything in this arrangement he thereby demonstrates that he is a profiteer, selfishly trying to deceive and grab something for himself without giving equal value in return—and I am glad to have gained his ill will. I make these remarks because my stand in this matter has already been attacked—that giving direct evidence that they are needed. (For theory of middlemen, see §170o.)

§G. a. It is the opinion of those who are probably the best judges that a book is an actual commercial success if it is intrinsically interesting and so is recommended by one person directly to another. I shall spend no money advertising this book, and make but a negligible effort to give it publicity. I think the book is a useful one and worth reading—rather more so than the ordinary book. If the reader concludes that it is worth reading, he would, if he is right, usually be useful to his friends by recommending it to them. And his doing so would be ample compensation to me; for if the book *is* useful, thus I shall in due time get paid for the several years I have spent on it (principles of payment are in §168). If I have an opportunity I shall inclose one or more circulars in the books I send out, for the convenience of those who may want to use them.

b. I find by experience with various people that, because there are so many stand-patters who consider a sound book of this sort impossible, it takes unusual courage to recommend it publicly. So judged by that evidence the men who wrote the introductions have displayed that fundamentally essential trait in the degree that is leadership (§§170r, 167b).

S. Klyce.

Winchester, Massachusetts,
September 17, 1921.

INTRODUCTORY REMARKS

CHAPTER I. *Summary of contents and their character.*

§1. a. This book is a brief description, and rigorous proof of the truth of the description, of the universe and all that appertains to it, both "spiritual" and "material." Hence, the book is religion, science, and philosophy. If those three names of the main "branches" of knowledge are taken in their customary senses, I am unable to determine which name properly designates any given portion of the book. The three are actually unified.

b. But although all three branches of knowledge are thus included, one general method is rigidly and without exception adhered to:- all statements and conclusions are based on experiment, so that the reader may also verify them by his own experiments or experience. When such a *method* is used, the product nowadays is usually called science; but in that case "religion" and "philosophy" become identical synonyms of "science." Personally, I have no preference in that matter of names; simply for convenience the three terms are hereafter used as applying respectively to the three possible and conventional *ways of expressing* the same thing (§39).

c. Although everything is to be experimentally verifiable, the description is not therefore "materialistic." In all conventional fundamental senses this book is far more definitely idealistic than are (say) the doctrines of Plato or Berkeley or any orthodox theologian. The leading scientists of the present day, such as Richards, Jordan, Chamberlin, Patten, Hale, reach conclusions the opposite of materialistic, as we shall see (IX, X). It is at the same time quite true that some of the men who claim to be scientists have been materialistic, and have damaged the prestige of science with intelligent people. Later we shall see explicitly how such men as Ostwald, Clausius, and other Germans have been materialistic, and hence wrong (see especially §147).

d. But the argument of this book, although idealistic in the popular sense (§49, etc.), is not sentimental; it has more than the conventional mathematical rigor. For conventional mathematics are defective (§44), and the argument is given with the rigor of a properly corrected mathematics.

§2. a. We may first view the book as a whole by noting how it compares with conventional "science." The brief statement of such a viewing is that we shall find present science to be quite correct essentially, except that it is incomplete—as is of course acknowledged by most scientists. So it is completed, in a qualitative sense. In many cases we shall find that science reaches what are customarily termed religious conclusions. As strict science those conclusions are wrong in the sense that they are mislabeled and misapplied. Thus, the so-called law of conservation of energy is quite true; but it is religion, and not science. Or, to give a more directly concrete example:- Newton's law of gravity is correct as pure religion; but it is wrong, both in principle and qualitatively, when applied to any two ('scientific') bodies such as the earth and the sun (§§74, 73d, 83f).

b. But that statement of the scientific aspect of the book is perhaps too broad to be comprehended at this point. So we may take a more concrete view of science, and note just how it is proposed to complete science.

c. Careful mensuration is considered to be the proper basis of present science. Kelvin declares that "nearly all the grandest discoveries" of a legitimate, valid science have been "the rewards of accurate measurement and patient, long-continued labor in the minute sifting of numerical results." —— I substantially quote this paragraph from Richards (Faraday lecture, 1911; "Science," N. S., 878).

d. The last paragraph asserts in effect that experiment or experience is the correct method of getting science, and then states the best method of experiment:- careful observation or "measuring." (Later I prove that the assertion is true; see especially §§38-9; also 36-7, 57, 59, 60, 150.) But the use of that method by no means exhausts what science must do, and actually does do:- it is obvious that whatever is obtained by those experiments must be expressed, stated, communicated, classified—and *is*, before it is even known as science.

e. So we investigate the expression—the *consistent* expression, or classification—of experiments, basing that investigation itself and consequent conclusions upon experiments or concrete evidence. (It is a "*circular*" process.) That investigation permits us to complete science. We promptly find that the fairly well informed average man is already in possession of enough "experimental" data to complete science, as soon as we derive a consciously definite and consciously consistent method of expression. Hence, it follows that the reader needs no wide acquaintance with "scientific" or "technical" details in order to judge the general truth of this book. However, some scientific detail is included for the use of those who need it, and to show the general reader the further implications of his present knowledge.

f. We shall find that there is a mere verbal trick which enables us to complete and unify all knowledge; to solve, verifiably and self-evidently, all qualitative problems—all problems of why, how, what, or all principles. We shall find that we already constantly use that verbal trick, but merely have not definitely noticed it—that it is an absurdly simple trick, the use of which is ordinarily named "commonsense" (§49l). The application of that easy trick to the thousands of details of daily life sometimes requires the consideration of such a number of things that it is difficult to remember them all, and we say that such application is *complex*. That is the only actual difficulty we have in "understanding" anything. A child can "understand" the "argument" or "reasoning" of this book. I have tried it on children of six and they did. The reader already knows the argument (§49q).

g. Now, Kelvin himself elsewhere clearly implied that the expression of science is defective. We have him complaining:- "Quaternions came from Hamilton after his really good work was done; and although beautifully ingenious, have been an unmixed evil to those who have touched them in any way, including Clerk Maxwell" ("Life of Lord Kelvin," 1138; quoted from Shaw, "Philosophy of Mathematics," 98). Maxwell used quaternions to express the theory of electricity that is still substantially used. So it is clear that there is more to science than measurement.

§3. a. The last section implies that mathematics is the means of expression used by orthodox science. So we may view our book from a mathematical aspect.

b. We noticed Kelvin objecting to a certain sort of mathematics that is explicitly used in a large part of science. Somewhat contradicting Kelvin, it would be easy to quote a number of scientific writers who substantially hold that those without a knowledge of the so-called higher mathematics can not understand many things that are true about the universe. We shall see that those writers are wrong.

c. The fact is that mathematics is simply an abbreviated method of expression—a formal shorthand language (§30). It is based on precisely the same method or trick that ordinary speech uses (§30). Orthodox mathematics itself contains a fundamental inconsistency or self-contradiction. The mathematicians themselves admit that it does. Russell ("Ency. Brit.," xvii, 881) shows it, and says it may be removed in a certain way; but Shaw ("Phil. of Math.," 77-8) substantially disagrees that Russell removed it, and quotes Poincare, one of the most renowned of recent mathematicians, as despairing of mathematicians' ever agreeing on it. So it is clear that mathematical authorities themselves imply that orthodox mathematics serves to confuse science, rather than give it any fundamental intelligibility.

d. As orthodox mathematics are afflicted with such inconsistency, I shall as a general rule not use some branches of them. It will be shown in general how to correct—more accurately:- complete—them. But this is not a book on mathematical detail, and extended revision of mathematics is omitted. It will be shown how ordinary algebra, when used in a consistent way, gives highly abbreviated expressions which we can easily keep in mind: a short formula will summarize the whole verbal trick. So we use that formula, derived in §§33-8.

§4. a. The consistent expression of experience is conventionally named *logic*. The mathematicians call substantially the same thing *logistics* or *symbolic logic*. The trick of language, or the theory of language, will therefore be given that conventional name *logic*.

b. That name has a formidable sound. Orthodox logic *is* formidable, as it is quite unintelligible if taken at just what it says. (That means the ordinary textbook logic; there are several valid treatises—§49o-q.) But valid logic is excessively easy—precisely that: so easy that such logic was usually taken for granted and overlooked, so that we have had such monstrous books as Kant's "Critique of Pure Reason." The fact which we shall find (§49) is that the average man has been using the valid logic right along, and that it is very simple as soon as we are conscious of what it is. —— We are not going to trouble ourselves with syllogisms, and other such horrors of our school days. In fact, we are going to see that in the conventional senses there are no such things as "logic" and "reasoning."

c. We shall readily see that the well advertised "mystery that shrouds the ultimate nature of the physical [also spiritual] universe" is nothing more than our previous more or less unconsciousness of that trick of verbal expression which we continually use. The mystery and the "Veil"—all "Unknowns," and especially "Unknowables"—simply turn out to be the things we really know best, as soon as we see just how we have been talking. Valid logic itself has the characteristics of a "machine" (VIII). So the puzzling "mechanical" aspect which the universe seems sometimes to take is an aspect of the verbal *method* used to describe it.

d. Hence, this section and the last merely assert that, both from the conventional point of view of science and of mathematics, by using a simple trick or *method* of expression or language, we solve all qualitative problems.

e. I may add here that always we have to solve *quantitative* problems—*how much?*, *how many?*, *when?*—for ourselves as we go through life. *Never* can such problems be solved *accurately* except by actually "living" them. The qualitative solutions given in this book do not take away the need of continually solving such problems of actual living, and it it rigorously proved that never can such problems be otherwise solved (§§25d, 40-1, 50, 167, 173; cf. §66g). So no one need fear that this book or any other is ever going to remove from man all need of mental effort, by solving all qualitative problems. It sounds paradoxical; but we shall see that it is quite simple (III).

§5. a. From the point of view of actual life the idea or result or purpose of this book is to prove that man knows all qualitative truths—thus absolutely destroying agnosticism and kindred views. In short, for everyday living, the book replaces ignorance with knowledge. It will be shown that ignorance is the only "sin" or source of pain (§164c); and "faith" and dogma, by their very definitions, acknowledge some degree of ignorance, and are sins. However, it is to be emphasized that the actual facts, the verifiable truth, dictate that purpose of the book—not any arbitrary fancy of mine. In no instance do I indulge myself in any "purposes" and "aims," in the vague conventional sense of inexplicable or truly primary or uncaused desires—for all kinds of absolute "purpose" or "First Cause" or teleology are proved to be wrong (§§86d, 144h, etc.). In all cases the facts govern: I personally, as the writer, merely record; and the reader observes and discovers for himself. I am not an "authority"; the universe as a whole is the real authority. I do not preach. I "urge" nothing on the reader, and do not so much as "invite" him to do anything. I do not dictate in any way.

b. In many places hereafter we see that the point of view set forth in the last paragraph agrees with things as they are. Here, I may show in rough physiological terms that agnosticism is damaging:- If the nerves controlling the beating of a man's heart were to become 'ignorant' or agnostic of just what they were doing or 'wanted' to do, then as a truism they would be vacillating, uncertain, unreliable; and if they were really agnostic or quite ignorant—and not just partly or 'formally' ignorant,—they would as a truism stop working, and the man would die. But even the minor vacillation would be "heart disease." Obviously, if his "higher" nerves become really agnostic, they stop working, and he is partly dead. He would, as a truism, die wholly if he actually were agnostic about everyday living. —— We shall see that no one is really agnostic: people are ignorant only in a quantitative sense, and not in a qualitative sense (§§25, 49). Also, agnosticism in practice is turning out to be a favorite disguise of the dogmatist, obviously saying this for him:- "See how very modest I am in admitting ignorance. You ought therefore both to praise me for being modest, and also unquestioningly to believe what I assert I know, as that modesty proves my reliability." —— I shall implicitly show in this book that an assertion of ignorance requires as much proof as one of knowledge; that it therefore by no means follows that such a dogmatic agnostic is either modest or reliable.

c. But because the method of using language rigorously has previously been somewhat unconscious, although the conclusions got from the method were consciously called "commonsense," there actually are what we might call quantitative agnosticisms—partial qualitative ignorances, sins, pains, or partly dead nerves. The removal of those defects will truistically give "life more abundantly." The reader himself, by his own efforts in observing things as they are, gains for himself that more abundant life, as explicitly described in Chapter XVIII on ethics.

§6. a. It is difficult to give briefly at this point any easily intelligible summary of the religious conclusions which are to be established. That difficulty exists mostly because of the fact that theology is customarily considered to be religion, whereas orthodox theology contradicts religion, so that there is great confusion in customary terms for this subject. Another difficulty at this point is that it is not customary to consider religion as being a definite, verifiable matter.

b. Probably the clearest way of summarizing the religious conclusions that will be established is to state that the average American in his everyday life or work, and as the sum total of his thinking about it, has substantially achieved a true religion (§166e). Or, the sum of Christ's doctrines is valid. On the contrary, the "reasonings" and exhortations of professional theologians are usually not sound religion.

c. Perhaps the only explicit remark on religion which will be of much service at this point is that the theologians, in so far as they are explicit and not evasive (§48b), mostly teach Paulineism and not what Christ taught. It will be shown that Paulineism diametrically opposes the truth, whereas the substance of what Christ probably taught is correct (§§160-3, etc.). Considering them as men, I think theologians vary as do other men. Some are objectionable to me, while others are personally very fine. But taking them professionally—and unless otherwise noted my remarks refer to them professionally,—they are substantially wrong, and I am opposed to them (§§169d, 177b).

---

§7. a. The foregoing summary of the book from five points of view may unintentionally lead the reader to believe that what follows is perhaps almost exciting. But to most readers it will not prove to be so. It is more likely to seem at first to be rather dull and tedious. I have had some years of experience in giving the proofs and expansion of those summaries to various people—mostly to men with highly trained minds,—and the argument seems usually to depress them at first. However, occasionally it explicitly collides with some pet superstition of a man, and he gets quite excited. Ordinarily, though, this unification of knowledge is disappointing. It may be useful to the reader to have me point out the general causes of that possible temporary disappointment:-

b. (1) Many generations have been inventing pleasing yarns concerning the delights of having absolute knowledge. In the absence of having such knowledge, even now men often assert the existence of it in some future heaven. But apart from such rosy fairy tales, for generations even the responsible thinkers in their speculations have rather overrated the benefits that would immediately accrue from the possession of absolute and complete qualitative knowledge. So naturally the reader will be expecting too much. If he could discount those expectations about 95 per cent right now—which will probably be practically impossible,—he will not be disappointed.

c. (2) The next particular source of disappointment will be that the reader already knows the essential conclusions that are reached. As I have reiterated, I do nothing but use a verbal trick consistently. The reader does nothing but discover for himself that he already knows the essential truth. That will probably disappoint him at first, as it is not likely to be what he expected. For he may have the age-old, recurring idea that some Messiah, with mighty intellect, and an overpowering command of the disciples' emotions, would happen along and communicate undreamed-of, beautiful truths and happiness. It will clearly appear that such can never happen. The reader may resent the destruction of those expectations, the commonplaceness of the whole truth, and probably the commonplaceness of me and my ways.

d. (3) Because the reader actually knows the substance of our conclusions before he reads them, it follows that I am writing the obvious for him. About the most difficult thing to show is the obvious, as will appear. Peshaps it is even more difficult to see the obvious *consciously*—to observe definitely that we know it. "Philosophy" is the simplest subject there is. The difficulty with it is that it is *too* simple and obvious. Those unexpected things will perhaps exasperate and further disappoint the reader at first.

e. (4) The German type of materialistic scientist has taken Kelvin's phrase, "minute sifting of numerical results," as practically stating the sum total of any sort of valid knowledge. The German scientists of that sort so vociferously praised that idea that some others confidingly acquired the same delusion. If any such deluded person reads this book he will be disappointed—except that it is shown that in humanics (Part Three) there is probably not yet enough of definite measuring. For in this book there is added what the materialists omit, and what we have seen Kelvin himself substantially saying was needed (§2f). The book does considerable "minute sifting"; it is necessary, but it is only half the truth (the whole of Part One proves that).

f. (5) Finally, the reader is liable to be disappointed because I am too much lacking in skill in presenting the matter to him in the way he requires.

g. I know of no way, available in any practical length of time, of saving the reader from one or more of those possible dissapointments, or I would use it. If he has a youthful, vigorous mind—a condition not closely dependent upon calendar age,—it is nearly certain that in a few months, as the discoveries he makes gradually permeate his mind and become familiar, the disappointment will fade and he will find that he is extremely pleased, and really approves of things' being as they are. If the reader is surprisingly vigorous in spirit he may be at once pleased with the rigorous truth that the book proves. Personally, I am conservative, as was stated; and it took me a year or two to see the beauty of the truth.

h. But to the possible reader who is so unfortunate as to be rather firmly fixed or ossified in the habit of materialistic "science," and who requires—perhaps more or less unconsciously to himself—a long list of dry-as-dust obfuscating statistics, and nothing but such "facts," I can offer no pleasing hope. Both he and his mental brother, the persistently sentimental reader who prefers to believe much current theological and ethical dogma, will perhaps to their deaths mourn or resent that their beloved formulas have here been so plausibly questioned, if they rashly read further.

i. However, to the general normal reader I may offer another pleasant hope. It will be shown that the world or universe is correctly made. I am not a reformer, nor a grouchy pessimist—nor a Pollyanna glad-gamer. The facts do not permit me to be, as will be shown. On a basis of definite fact, I judge the present age to be the best age in history to live in, even though I consider people to be still very stupid. I do not think that I am as stupid as some people (I shall not ever bother the reader to praise me for having "modesty," as I have a negligible amount); but I find that I am enough like other people to prefer to associate with them—wouldn't feel at home among really intelligent people. So I like the human race very much on the whole, and shall not try to revise it. We are all on the way of acquiring more truth and hence more religion or life, or whatever the reader prefers to call the good we get. So the only panacea is experience—or in scientific technicality:- experiments. When we *consciously* get experience, we name it education.

j. Although I am thus correctly optimistic about qualitative affairs (§§149e, 161), in practical life I am able to see existing quantitative abnormalities, or unbalances, or undue departures from the average. I shall never bore the reader with any nonsense to the effect that everything in ordinary life is *quantitatively* good and lovely; for it is a fact that we (in usual language) say we dislike abnormalities in ourselves (usually calling them pains), and dislike to see them in

others; and such abnormalities sometimes do exist. From a *wider* point of view those painful things are good, and are needed; but we can definitely attain that wider view only by explicit recognition of that usual practical view of considering them painful (§177). From an immediate, direct point of view it is unpleasant to contemplate an extremely skinny man, and equally so to contemplate an extremely fat one; both departures from the normal or balance or the immediately pleasing are obviously dangerous to life, or limit life. The "upper ten" and the "submerged tenth" are abnormal, and when we come across them I shall not deny that they are. As we are getting a description of the universe, which includes all things, as a detail it will have to be shown that the I. W. W. and the domineering, profiteering employer *persistently* try to depart—in opposite directions—from the normal balance or the temperate life, from the democratic or religious life; and are truistically offensive. So it is with the materialistic scientist and his counterpart the dogmatic theologian, the militaristic Prussian and the totally nonresistant pacifist, the dualist and the technical mystic, the autocrat and the socialist, the aristocrat and the tramp, the closet philosopher and the "rough-neck," the "pure" theoretical man and the blatant "practical" man. In brief, we shall see (XVIII, XIX) that a democrat is a balanced, temperate, religious man; and rigorous proof will be given that such a man is the only sort who is happy and can possibly survive. It is proved with mathematical rigor that our Constitution is in agreement with that and with all natural law (XIX). So the book will be pleasant from a human point of view, provided the reader is none of those unbalanced sorts of persons. —— In order really to prove anything about humans we have to connect the proof consistently with "natural" law. So I connect it—or unify knowledge.

CHAPTER II. *Order and relationship of contents.*

§8. a. We have seen roughly the conclusions to be reached. I shall now state the order in which they are given, as that shows briefly their general relationship.

b. The portion of the book following these introductory remarks is divided into three parts. Part One gives a formal or general unification of knowledge, by showing the language trick. Part Two gives a unification in "concrete" terms of "matter"—or is physical science. Part Three gives the unification in "spiritual" or "mental" terms, and is the science of human beings, or humanics.

c. Those three Parts are briefly outlined in the next three sections. Here it may be emphasized that in *substance* all three are identical. I. e., each Part is essentially a repetition of the other two: the same principles are merely repeated in terms of different things—the essentials of *words* in Part One, of *matter* in Part Two, and of *men* in Part Three being identical. All the different "sciences"—the *expressions* of all aspects of the universe, of all modes of living, of all jobs in life—are merely repetitions of the same essential things. They are simply different points of view—quantitatively different expression—of the same thing, regardless of how widely different their names may at first seem to be. Obviously, such repetition is a truistic result of unification: for unification means the *ultimate* identity of all things.

§9. *PART ONE. — Formal Unification.* a. The first form of unification gives the verbal trick. The statement of that trick or method may with about equal accord with conventions be named (1) the theory of language, or (2) the theory of mathematics or (3) principles of mathematics, or (4) logic. And as I shall make a concrete model of language (VIII) which is a machine, the statement of that trick could also properly be named (5) mechanics. But as Part One does not explicitly discuss what are ordinarily called "concrete" things, that Part could also rather conventionally be named (6) philosophy. And also, because the language trick is found to be identical with what in theological technicality is called the Trinity, Part One might with verbal conventionality be called (7) religion. *Unification* itself means "consistency"; and as consistency is simply "valid classification," which is conventionally "science," Part One is also (8) science.

b. Thus it appears how unessential mere names are. I endeavor to use names in the way that is generally customary. But as soon as we begin to get a real understanding of things, names begin to coalesce—sometimes with such persistence that even temporary verbal distinctions become hard to hold.

c. Obviously, so far as *formal* completeness is concerned, I might end the book with Part One. For it essentially unifies knowledge. But so far as that goes, knowledge is also completely formally unified in the first few paragraphs of Part One (§12). We need further repetitions of the unification as a proof that actual unification is possible (cf. §35), and in order to get directly applicable conclusions. For centuries there has existed a formal unification in the word *God*, or in the word *universe*—and neither unification has practically proved to be very applicable, or intelligible.

§10. *PART TWO. — Concrete Unification.* a. Consequently it is proved that mind and matter are identical (§§46, 150), and our unification of knowledge is explicitly shown in Part Two to hold good with respect to "matter."

b. The doing of that constitutes physical science. We shall see that such science is very useful for our purpose because its terms permit us to be definite. And its concepts are simple, and hence easily grasped. So it is excellent as an introduction to the difficult science of humanics—difficult because of the numerousness or "complexity" of its details, which are hard to hold clearly in memory. That physical science is also directly useful of itself, as it is an intelligible description of the "environment," which we continually use.

§11. a. *PART THREE. — Spiritual Unification.* a. The last part is another repetion of consistent knowledge, given in terms of humans. That final repetition is crucial proof that matter is mind—it being the actual consideration and use of matter as such in a way that obviously agrees with the facts.

b. Part Three is, practically, the direct application of a unified knowledge to our immediate interests. It is familiar, and can be used by everybody—is used, in fact; for I merely describe how people act. In Part Two we see that every atom, our solar system, our galaxy—every so-called material thing—is a live personality with actually as many traits or "properties" as a man. But in physical science we can not see those traits so well; hence in each sort of "material" structure we explicitly consider only the few outstanding properties. And that "simplicity," which is really meagerness, permits us to work up gradually to a consistent grasp of the numerous perceptible properties of men. But at the same time, much of Part Two is unfamiliar and "uninteresting" to the general reader simply because those properties of atoms have not been conventionally named like the same properties in humans, and so atoms are not at once recognized from the very names as being like himself. The general reader will hence necessarily find Part Two to seem somewhat "abstract" at first. There is no need that he try to remember Part Two. But at least a casual acquaintance with physical science is needed for any actual understanding of ourselves, as we shall see at some length.

c. In writing Part Two I have tried to show that most of it is of immediate interest to us, and to remove its verbal abstraction. But it is written with all the fundamental rigor I could put in it, as is the rest of the book. Nothing has been "prettified" or sugar-coated for a lazy mind. Throughout I omit many details, the explicit statement of which would serve more to complicate than it would to forward the main thread of thought. Many such details I know; but I am quite aware that there are enormously more of which I am not explicitly conscious—although the argument, as is proved, implicitly includes them all. But everywhere the book is written "up," in an attempt to equal in worth the work of the best experts in each particular subject, and to interest them. However, the normal reader will find that he is quite my equal in most subjects and superior in some, if he will only take his ability for granted, and ignore the superstition that there is something esoteric and appallingly recondite about ultimate knowledge.

PART ONE

FORMAL UNIFICATION; or THEORY OF LANGUAGE

CHAPTER III. *Nature of the general problem and its conventional name; or, what apparent failure in unification requires reconcilement.*

§12. a. In this section we shall see in a brief, concrete form the whole trick which definitely unlocks all truth. After that I shall prove the need of such an unlocking, and then begin in a more comprehensive and generally applicable fashion to express and apply the trick.

b. Without stating the proof explicitly, it still will be rather obvious that we may make a typical form of statement or *sentence*, thus:- 'Two things plus [or:- and] three things are equal to five things.' —— We may abbreviate it, thus:- 'two and three are five.' Or we may abbreviate it still more:- '2+3=5.' The only other general form of statement is what is called the *truism*, in which both sides are explicitly identical, as:- 5=5, *A* is *A*, *A*=*A*. Later we shall see that all true or-and intelligible statements can be reduced to truisms (§§35-7); we can see at once that our 2+3=5 is really the same in meaning as 5=5. Most of the sentences we use are obviously but slightly removed from being explicit truisms. E. g., *John is a boy* means that *John* [*whom I know to be a boy*] *is a boy*, or *Boy*=*Boy*. Or, we could call "*boy*" a "class," and finally get the truism in the general form, *One unit* [*who is named John*] *is one unit* [*in a collection or class named "boy"*]; or, 1=1. But we need not go into that here. It was mentioned merely to make it reasonably obvious at this point that, unless we make sentences which are explicit truisms, the general form is 2+3 =5. And that sentence is itself only one step from a truism, as noticed:- for the first member, 2+3, is obviously 5, and we have, 5=5.

c. So we start with merely the general form of statement, in an abbreviated form:- 2+3=5. In the first member of that, we have *two parts*, '2' and '3'. I. e., the first member implicitly asserts that there are *two* collections of things, which collections are at least *verbally separate*. The last member of it asserts that there is only *one part*, '5.' I. e., the last member implicitly asserts that there are *not* two collections of things, but that there is one collection *not* verbally separate. In short, so far as *form* or *language* is concerned, the last member *formally contradicts the first*. Hence, in our typical sentence, we say a thing is so; and then promptly, and as a part of the very same sentence, say it is not so.

d. Well; by all conventional views of logic or "reason" our typical sentence is thus verbally or formally positively and completely illogical and irrational, as it says one thing and then at once says it is not true—as it flatly contradicts itself. But by ordinary commonsense—by direct observation or experience—we know that the typical sentence is correct or true. In fact, a proverbial symbol for obvious truth is the statement 2+2=4; and I should have used that, except we needed to distinguish one 2 from the other 2, and it is hence rhetorically less awkward to use 2+3.

e. Therefore, we simply use observation or "commonsense," and conclude that orthodox logic or reasoning is wrong, because 2+3=5 is correct. Then we further conclude, as being the total essential of a valid logic, that in any sentence—i. e., completely stated and *intelligible* sentence—which is not a truism of the form *A*=*A*, we *must* have a formal or verbal "contradiction," in the respect that *parts* are asserted both to be *parts* and *also* to be combined into a *whole* which is *not* parts. In fact, we may readily see that to make such a "contradiction" is the whole purpose and use of language:- to combine parts into a whole: to make names of parts coalesce into a *formal unit* that *means* the whole. —— That states the essential of language and the whole verbal trick. We *apply* that trick, and thus unify knowledge, by adhering to the simple rule:- make sure that the valid—or "rational," or "true"—sentence does contain such a formal contradiction; if it does not, and is not a truism, it is really nonsense.

§13. a. That is the sum total of the essentials of valid logic, and it implicitly contains the solutions of all qualitative problems. The last three paragraphs express all the real argument of this book, and there is nothing in all of knowledge any more difficult to understand than those simple observations. The reader knows that logic already. He uses it daily, as "commonsense," without even having to "think" about it. He is so expert at it that he would find difficulty in saying how he does it, just as he would find (perhaps much less) difficulty in stating precisely what motions he makes in putting on his clothing. Below in this book I merely point out the details of that familiar logic, and the reader verifies them by his own observation and discovers that he knows all answers to questions of principle.

b. So I now begin to translate that simple argument into the various aspects of it we have become accustomed to use.

---

§14. a. As we proceed we shall see in more and more detail that the formal contradiction occurring in that simple typical sentence is inherent in positively all knowledge or expression. I shall state in this section some of the more general aspects of the contradiction which have been recognized, often for centuries (also cf. 5th and 6th paragraphs of Dewey's Introduction).

b. For each one of perhaps a thousand points of view that contradiction already has a definite conventional name. The "philosophers" long ago (they were the scientists of those days) named the formal way of speaking of parts—e. g.,

of our '2' and '3'—the *Many*; and the formal way of speaking of the whole, the *One*. Or perhaps mostly, they called the parts themselves, the Many; and the whole itself, the One. Usually I shall not need to be explicit about such a distinction between *parts* and *expression* of parts, etc. (cf. §36). And when the philosophers had assigned those names, some asserted that the Many was "real" or the "truth," and the One false or "seeming" or "appearance"; and others said it was not so—that it was vice versa. And that dispute was and is named the problem of the One and the Many.

c. We shall see in detail that the problem is by no means an academic one, without appreciable effect on actual life (see Index, s. v. "One and Many"). For identically the same problem is involved in the theological Trinity, and disputes over that plunged peoples into wars for centuries and still produce clashing, expensive sects. Whether a democracy is right, or an autocracy or other sort of aristocracy, is the same problem (XIX). As the problem has not before been rigorously and with explicit consistency settled, it fundamentally produced the world war, which was an attempt, perhaps more automatic or instinctive than conscious, to find out how much aristocracy could be imposed on people.

d. We have already implicitly seen in our concrete example $2+3=5$, that the problem of the One (the whole) and Many (parts) was not an actual problem at all, but simply a puzzle of form—of arbitrary use of language, of verbal technique. Man invented a language; and he thereby created a verbal puzzle which he fancied was a real, world-shaking problem. And he finally got so befuddled that he called it the riddle of the universe—or if theologically inclined, the mystery of God. The human race took words, mere words, far too seriously—made idols of them. The race have been highbrows:- idolaters of words, the last species of a long line of idolaters of more tangible things. However, we shall see that the normal man actually did not get so befuddled: he merely made no explicit reply to the numerous varieties of aristocratic exploiters who kept misusing language according to their own mistaken ideas of self-interest until they came to believe their mendacities and evasions. That befuddling, highbrow bunco game is now mild in comparison with the past. But it may be observed still—nearly surely in this morning's paper, unless like the Boston "Transcript" it has an editor especially well ballasted with fair-play commonsense. This book explicitly shows how the priesthood of that last, most subtle idolatry work their game.

e. The sum of the matter is that there exists no riddle of the universe, no mystery—that there exists no *real* problem of any sort. The solution we shall get to that pseudo-problem, which we have already seen broadly given by everyday observation or commonsense in §12, is that the One is true, and that the Many is also true in a formal way, even though they are formally contradictory. We shall simply investigate those formal contradictions, and see how to keep out of any real contradictions, and how to eliminate our various verbal puzzles.

§15. a. We may go somewhat more into detail as to the modern forms of the One and Many.

b. John Dewey, in the "Introduction" of his "Essays in Experimental Logic," definitely implies continually that this One and Many underlies all philosophy or logic. Dewey is accepted by the experts as a leading authority (see Riley, "American Thought"; "Ency. Brit.," xvi, 918, footnote 6). I think he is one of the best of all philosophers, logicians, and psychologists—and I may add that since he wrote the Introduction for me I naturally think so more emphatically. And William James, who was finally in his "Radical Empiricism" almost as sound as Dewey, says somewhere that he has come to believe that the One and the Many finally underlies all problems.

c. Russell, one of the leading mathematical authorities, shows in a general way ("Ency. Brit.," xvii, 881) that the One and Many is at the base of mathematics, and points out the contradiction—which he says he obviates. We have seen (§3c) how the mathematician Shaw disagrees that Russell avoids the contradiction, and states that Poincare was doubtful of ever reconciling mathematical differences of opinion over infinity (*infinity* is one mathematical name for the One—see §§30, 43).

d. Technical scientists rarely use the "philosophical" name, "One and Many." But we may quickly find them asserting the existence of the "problem" in the most orthodox of treatises. E. g., Maxwell is quoted in Watson's "Physics" (p. 2):- "The difference between one event and another does not depend upon the mere differences of the times or places at which they occur, but only in the differences in the nature, configuration, or motion of the bodies concerned." In that statement Maxwell is obviously trying to say what really divides the whole or One of things into parts or "events" of the Many (and as he didn't know, his statement is, as we shall see in time, confused and unintelligible—although it is given children to learn). And three times he uses a form of the term "*difference*," which is itself a technical philosophical term—the problem of Differences—that is substantially a synonym of "One and Many."

e. That shows with great brevity that authorities agree that the One and Many is fundamental, even though they name it variously. As we proceed we shall incidentally see all kinds of authorities naming the problem, and puzzling over it. The general statement of the problem obviously is:- we *seem* to see the universe in two opposite aspects, (1) split into parts as the Many, and (2) connected into a whole as the One, or universe: and the problem is, *How reconcile that apparent contradiction?*. —— We are now ready to see, by our own observation and without any of the explicit support of convention and authority which I have been citing above, that the problem is fundamental, even though we state it in everyday "scientific" terms:-

f. First, we consider broadly the very bottom thing of science, a "machine" (for details, see §§21, 86f, 96g). When we say a machine works—and obviously it is not a machine in a conventional sense if it does not work,—we consider the machine as a unit—as a One. Equally obviously, the machine is made up of parts, which are the Many. Everything which we conventionally call a machine has at least two perceptible parts:- e. g., a lever is the bar (or "lever") *and* the fulcrum; a screw is the thread (the "screw") *and* the nut; the inclined plane, as a machine, is the plane *and* the load on it. In each case there is a *frictional union* of *parts* which may be "separated." We may make a typical sentence for, as, or "describing" a machine:- *One part plus* [*i. e., held on by some degree of friction to*] *at least one more part is a machine.* Or, we may abbreviate:- *One part + One or more parts = The machine, or the Whole.* Or, *The Many = The One.* —— There, in a "scientific" "machine," we obviously have parts equal to a connected whole—which is *formally* contradictory. But obviously, *both* are true (so far, we see by ordinary commonsense that they are true; later it is *explicitly* proved to be true—IV). So again we have our general "solution":- *The Many=The One.* And we see at once that the mistake some people have been making as to "machines" was that they emphasized the *parts* of the machine, and overlooked the equally true fact that there was a machine only as it was

a connected, consistent, really inseparable whole—related together as a structure, or organism (XI). When a baby takes apart a watch it is no longer to him a watch—it is not a watch except as it works together. When an infant philosopher or scientist or theologian takes apart the universe—"analyzes" it, not into a "machine," but into machine *parts*, —he can not put it together, and to him it no longer is the universe or a whole; to him it is a pile of mental junk, variously named agnosticism, dualism, etc. But, the obvious fact is, he never did actually take the universe apart; in his egocentric, anthropocentric way (§§40f, 73h, 100, etc.) he just fancied he did. The universe kept right on working, and his "analyses" produced no real problem.

g. Newton's first law of motion, which asserts inertia, explicitly states that no body can move unless acted upon by another body (§88). If we agree to *say* that bodies move (we *could* construct a valid science, wherein nothing verbally moves—§97), then at once we imply that in some way the universe (the One) is as a whole made up of parts (the Many) which are *connected* in some way that permits motion (by orthodox logic no such motion can occur—Index, s. v. "Zeno"). And as we shall see (§88), the other two laws of motion were Newton's attempt to assert that there was no logical contradiction in that assertion of inertia. In short, his laws were an attempt, surprisingly successful for that age, to solve the One and the Many.

h. The last two paragraphs give two of the thousands of ways in which science names its forms of that so-called philosophical problem of the One and Many. I may at this point merely name some other ways that will probably be seen obviously to involve the problem.

i. There is now much apparent conflict between "quantum" theories, and "continuous" energy theories—such as wave theories. Those quantum theories in effect assert that fundamentally the universe is divided into parts (here, parts of energy—the term *energy* being the more usual scientific name for *universe*). The opposing theories assert that there is no such division—that the universe in continuous (XIII).

j. That conflict of words begins far back in scientific history, and comes up to the present day. Is heat small, Many motions (and if so, a Many of what?); or is it continuous phlogiston? Is electricity continuous energy (the One), or discrete as electrons or corpuscles? Usually now it is taken as discrete; but the question has already come up whether electrons are continuous inside. Is light continuous as waves, or discrete corpuscles—or in modern terms, discrete magnetic disturbances? Or, in more generality, are there *exact* or eternal or absolutely separate atoms (the Many); or no exact, really separable atoms (the One)? The so-called kinetic theory gives two answers to that which contradict each other (§89, etc.). And the electron theory is in the same contradictory condition:- Thomson and his school hold that electrons have tubes of force, which substantially amounts to continuity; and the other school have discrete electrons in what is substantially the older kinetic theory.

---

§16. a. I think that is enough evidence of the general need of an investigation of the One and Many. It is probably already obvious to the reader that the investigation, even if it does apply only to a verbal confusion, is of fundamental importance in reaching a conscious understanding of things, regardless of whether we consider those things as belonging to science, philosophy, or religion. So we begin the completely explicit solution.

§17. a. "The Encyclopaedia Brittanica" (11th edition) seems to me to be the most reliable generally available authority as to what are orthodox doctrines concerning most subjects. As I am trying to use words in their customary senses, so as to be easily intelligible, I shall frequently cite that encyclopedia as giving such general agreements as to words and facts. Hence, in developing the meaning of "One and Many" I shall show some of the details of the orthodox difficulties by quoting the important parts of that encyclopedia's articles on pluralism and monism:-

b. Art. "Pluralism":- "Pluralism ***, a term used *** in philosophy for any theory which postulates more than one absolutely distinct being or principle of being [postulates the Many], opposed to monism. Pluralistic systems are based on the difficulty of reconciling with the monistic principle the principles of variety [or Difference] and freewill. The chief difficulty which besets any such view [that there is an absolute Many, or pluralism] is that if the elements are absolutely independent, the cosmos [universe] disappears and we are left with chaos: if, on the other hand, there is an interrelation ***, the elements [the Many] are not ultimate in any intelligible sense." —— I. e., if the universe is not chaos, then as a truism it is not possible to say (as a concrete example), that there is any actual difference which will permit us to distinguish between a man and a moon. Clearly, if we take language forms as seriously as the writer of that article, we are fundamentally forever barred from knowing anything.

c. Art. "Monism":- "Monism, *** the philosophic view of the world which holds that there is but one form of reality, whether that be material or spiritual. The aim of knowledge is explanation, and the dualism or pluralism which acquiesces in recognizing two or more wholly disparate forms of reality has in so far renounced explanation (see Dualism [i. e., the Article quoted in the last paragraph]). To this extent monism is justified [probably the writer means that monism is justified in that it 'explains']; but it becomes mischievous if it prompts us to ignore the important differences in facts as they present themselves to our intelligence. All forms of monism from Plotinus downwards tend to ignore personal individuality and volition, and merge all finite existence in the featureless unity of the Absolute; this, indeed, is what inspires the passion of protest against monism. Turning to the historical forms of the theory *** [there follows a short statement of philosophical technicalities not needed here; and it may be added that there seems to be evidence of Chinese monists centuries before Plotinus]. Those who maintain that all these forms are hasty and superficial stand by the conviction that the right philosophical attitude is to accept provisionally the main distinctions [differences] of commonsense [but we saw, in the case of the machine, §15f, that commonsense gave also a One, as well as that Many], above all the distinction of personal and impersonal; but to press forward to the underlying unity so far as experience and reflection justify."

d. We may note that the writer of the second article speaks of "a passion of protest." In short, the reason people have not agreed on the One and the Many is, from one point of view, because they took mere words so seriously as to become violently emotional over the problem. There is current an odd fiction that philosophers are unemotional (for the psychology or "human nature" of it, see §155); but we have just seen the staid "Brittanica" tacitly agreeing that it is proper for emotions to keep professional philosophers from agreeing. It is sometimes fancied that scientists do not thus let emotions interfere with *their* consideration of the actual facts. But some in real life become violently emotional the minute this problem is mentioned; e. g., one professional astronomer spat out "metaphysician" at me, as the vilest epithet he could invent, because I incautiously used with him

the name "One and Many." —— Those remarks are made to show that there is all the emotion there is, concealed under the apparently harmless and abstract "philosophical" problem of the One and Many. We are going to go cautiously with it, so as not to set off any premature emotional explosions. (See Dewey's recognition in his 8th paragraph of one of my methods of doing that which I agree I have overdone, but which I don't dare modify.) But when we have the solution thoroughly controlled, it is to be shown that a real grasp of the problem is an ultimate religious experience, or "conversion," or "rebirth" (§§153f, 162).

§18. a. The *One* is therefore a conventional and useful technical term meaning that the universe with all its phenomena is inherently continuous or joined together; or is an absolutely inseparable or indivisible unit. We shall see the proof that the universe is really thus; but at the same time we shall see that it is absolutely impossible to make a *positively* intelligible statement or expression about such a universe. Consequently, to anticipate—perhaps somewhat unintelligibly here,—the universe will arbitrarily be talked of as a pluralism—explicitly as an '*infinite pluralism*,' which is a formally self-contradictory name, not before used in that sense so far as I know.

b. The *Many*, as a *conventional* technical term, means that the universe is made up of more than one part, each part being absolutely distinct, separable, and absolutely real in itself; "the Many" is the conventional name for the parts. Obviously, such a 'collective' name is *essentially* self-contradictory if it is supposed to have a real meaning, if the parts are absolutely separate; for in that case they are truistically absolutely *not* collectible, even verbally. Hence, in this book we shall not have "the Many" used with that absolute conventional meaning. I shall use it as a term, admittedly *formally* self-contradictory and desirably so, which asserts or implies that we have *arbitrarily* divided the universe into parts, basing the division upon certain agreements among men (§100, etc.). For, to anticipate the proof again—and again perhaps somewhat unintelligibly here,—when we are *positively* intelligible in our language, we have to speak concretely of the Many; an actual language is otherwise impossible (IV). Also, we may validly hold that the *infinite* Many is true, or is the One (§49).

§19. a. The only other technical philosophical word which the reader need remember is *dualism*. Instead of using the now unfashionable theological name *devil*, I say *dualist*—and there are many professed dualists, although as a matter of fact there can not possibly be a real dualist, as we shall see. Kant, in so far as he was explicit, was a dualist; the Germans took him seriously—and see what happened to them.

b. By *dualism* I mean that nonsense which is dressed up in the orthodox "logical" form—i. e., all explicit, formal orthodox "reasoning" is dualistic and nonsensical. I shall describe that conventional form by this quotation in substance from Art. "Dualism," "Ency. Brit.":- *Dualism* is a term that is applied to all doctrines which try to explain facts by classifying them all under two coexistent and separate or distinct forms or "beings." Dualism in technical philosophy postulates—i.e., *assumes* and then undertakes to prove—the eternal coexistence of positively separate mind and matter; it is thus opposed to an "idealistic monism" and a "materialistic monism." [The "Encyclopaedia" says there are those two sorts of monism, thus obviously making "monism" also *finally* dualistic; as a fact, the German variety of "monism" does in effect make so-called monism a dualism—§49.] Similarly, there are two forms [a "dualism"] of dualism. One form is that mind and matter are absolutely heterogeneous [that is the form that has been substantially stated just above]. The other holds that matter in its usual sense does not exist, but that we have an "idea of matter," and the dualism then consists of the eternal absolute distinction between (1) the idea of matter, and (2) ideas themselves, or "reason." —— The reader need not worry if he fails to understand all that: it is unintelligible *when considered explicitly*. I have been simply quoting—translating into my crude, common words. Indirectly and implicitly, that formal dualism contains the basis of truth, so that it will vaguely mean something:- for we saw that dualism at once formed a dualism of dualism: that regress actually implicitly goes on indefinitely and gives the truth (§§23-4). But that remark is not intelligible at this point.

c. In the Article "Dualism" there are given numerous historical facts about the forms of dualism. E. g., according to the encyclopedia the "Christianity" which holds that there is a God and a Devil is substantially dualistic, and the morality that makes Good and Evil absolutely distinct is positively so. In suitable places below I shall solve those puzzles without burdening the reader with the explicit historical details. But I may mention here, in anticipation of the proof in §24c, that *all orthodox* pluralism is in final form dualistic, because orthodox logic is explicitly dualistic. In short, *all* positive expression in past history, previous to the present solution of the verbal trick, was *technically* a pluralism which was a dualism, and hence was technically wrong, if we hold it rigorously to a valid logical standard. As a matter of fact, very few people ever dreamed of interpreting previous expression thus rigorously: *substantially*, most past expression was right, and sensible people actually definitely disparaged the orthodox logic, and very great men like Christ practically repudiated it (§162e).

§20. a. We see thus that orthodox philosophical terms are quite self-contradictory. Orthodox scientific terms are as bad, as we saw in §15, and shall see in more detail from time to time. Those contradictions are obviously the attempts of various men to *dodge* the formal contradiction that is *un*dodgably inherent in the One and Many. So inevitably, those attempts to escape the inescapable simply, for each attempt, put the contradiction in a new place; and instead of resulting in a "solution" where no solution was needed, simply added one more verbal puzzle. (That is the whole qualitative history of "philosophy.") The attempt became more puzzling when the contradiction was made *movable* within a given "system," so that it wasn't "there" just when we thought we "had" it:- such an elusive state of affairs occurs in technical philosophical *mysticism* (analogous words are *mystify* and *mysterious*), or in Bergson's "intuition"; or in modern science, relativity is really an example, which by rigorously making the contradiction move infinitely becomes technically sound, as will become intelligible in §66.

b. We may here, in further detailed proof of the existence of such contradictions, *and as a useful means of becoming inoculated against taking any "isms"—"systems"—too seriously*, casually note some further substantial quotations from the "Encyclopaedia." I use the Articles "Realism," "Idealism," "Mysticism" (and of course what I thus substantially quote is, just of itself, mostly unintelligible—a deliberate but factually correct parody on the human mind as it disports itself in the "higher learning"):-

c. *Realism* is a "philosophical term used in two opposite senses. (1) The oldest of these is the scholastic doctrine, traceable back to Socrates, that universals have a more 'real' existence than things." A "universal" of a chair (say) is not real chairs, but the mental "ideal" chair. In its extreme form of this first meaning, realism denies the reality of

anything but "universals," and is opposed to what is called "nominalism" and "conceptualism." [That denial is of course logical nonsense; a "universal" is what we later call a relationship word—see §§57, 49 for the solution of that orthodox nonsense.] (2) The modern application of *realism* is to the opposite doctrine that there is a reality apart from such universals. There are several forms of that sort of doctrine:- e. g., "natural or naive," "ideal," empirical," "transcendental," etc. —— [Obviously from those quotations, the two opposite varieties of realism are tacitly both dualisms. But when expression is so vague and conflicting as those quoted definitions, no one can say positively what such expression does mean.]

d. *Mysticism* requires about five of the encyclopedia pages, the size of these, to explicate. The article says, to begin with, that mysticism is a "phase of thought, or rather perhaps of feeling, which from its very nature is hardly susceptible of exact definition"—[as a matter of fact, we have no difficulty in this book in considering it under the name of infinite regress, which in psychology is called by the very common names emotions or feelings—see Index, "Infinite regress," "Emotions"]. "Most frequently it [mysticism] appears historically *** as a reaction of the spirit against the the letter." In short, orthodox historical mysticism makes an inconsolable contradiction between "spirit" and "letter" —and having no "letter" can not actually express itself. The emotions of mystics are "violent"; they are said to have "fervid Godward aspirations." —— [I may mention that several notable mystics have been considered by some to be on the border-line of insanity, if not over. Women sufficiently hysterical to be on the verge of insanity, such as St. Theresa, are often mystics in the orthodox sense.]

e. The "Encyclopaedia" uses six pages to explicate *idealism*. First, there are two rather opposed meanings:- (1) The popular meaning is substantially:- "abstract perfection"; i. e., "ideals." In that sense, idealism is a form of monism. As commonly used by the average man, I do not think that *idealism* is quite so exaggerated, but think that it is merely his name for the valid logic we are to deduce explicitly (cf. §49, etc.). (2) The technical meaning of *idealism* is:- the doctrine that conceives knowledge or experience as a process in which two factors, subject and object, stand in entire independence of each other. That of course is admittedly dualism. It is distinguished from so-called "commonsense dualism," which regards mind and matter as being in "more or less accidental relation" with each other, in that it "seeks to realize its own ideas"—[by which hysterical phrase I suppose is meant that it strives to relate its ideas into a One, and thus stultify itself, and flop over to the opposite first meaning]. —— The article states substantially that there is no contradiction between technical, dualistic idealism and James's pragmatism. But as a fact that is easily verifiable, James, in "Essays in Radical Empiricism," did *explicitly* flop from dualism to a monism that was really valid logic (§§49p, 156).

§21. a. Viewing that maze of nearly unintelligible conventional contradictions, the reader has probably seen for himself that orthodox philosophy is rather indeterminate. It was fairly obvious that the contradiction, which was shifted about from point to point by the various "ists" in their different "isms," is the formal one between the One and the Many. —— Of course I took the easy way and made a parody—a slight exaggeration—of that "higher thought." (Those past experimental efforts to get consistent thought were of course needed, and have actually been my guide in working out this book.) But a proper *constructive* summary of the whole thought of the race is given by Dewey in his Introduction. His summary is a masterpiece, and was far beyond my powers—in fact, the reader needs to know considerable about the history of thinking to be able to appreciate the excellence of that summary.

b. And probably the reader has seen already, in anticipation of the explicit discussion in the next chapter, that the whole aim of philosophy and religion, in the search of a *consistent* way of stating truth, was to get 'one part' related to, or joined in some way with, 'at least one other part,' in order to have the united, or One, meaning. In fact, as was indicated in considering mysticism (§20d), unless there are at least two such *verbally* contrasted parts, there can be no *positively* intelligible expression. So philosophy was always thrown back upon a dualism; and just as inevitably, as we saw under "idealism" (§20e), it then struggled from that really merely verbal dualism—which however it took too seriously, as being "real"—back to a united or One meaning. And obviously, *dualism* is nothing more than an equivalent name for "machine" (§§15f, 86f), or for "analysis." Scientists use "machines" and "analyses," and most of them, precisely as do philosophers, struggle to get away from that dualism to a popular idealism, or an intelligible "relativity," or a "unification," or "understanding"—or really, to an *explicit* religion. Those who are too weak to struggle much tend first to be "quitters" by asserting agnosticism; when they are sufficiently calloused to that lack of unification or understanding, they become materialistic—which variety of hardened, indifferent ignorance is, in everyday terms, named *cynicism*—the dogmatic ignorance of the quitter that is temporarily forgivable in the young, who almost invariably assume it for a while as a protection from becoming too fatigued by the flood of impressions rolling in (§155).

c. It is possible to go on from this point and show that philosophers, poets, and prophets have invented an idea they called God to make that dualism or machine work. When they asserted (as the result of short vision—cf. §47) that there really was a distinct dualism, then they obviously had to have something to make that apparantly totally disassembled machine get its parts together, and work together, in order that it be intelligible or do what we plainly see it doing. And they used their "God" to do that. Obviously, if God actually stuck the pieces together, then as a truism, there was *not* any longer a dualism, or dismantled scientific machine. And, unless the prophet himself actually created that God, then clearly the God existed previously, and there was *not* the dualism the prophet or scientist began by asserting existed. So we see, merely as a truism, that the idealist-dualists who 'seek to realize their own ideas,' and the realist-dualists who make their machine work somehow, both have, like the mystics, "fervid Godward aspirations" —which means, in commonsense terms, a desire to see things as they are (§§153f, 162, 166).

d. But we shall not spend any more time directly upon such vague orthodox philosophy or theology, even in order to see the interesting historical facts concerning man's intellectual inventions of God in his (man's) own image (§170jm). We shall proceed to make first-hand, rigorous investigations of facts for ourselves, and not rely upon picking out consistencies from the maze of conflicting "authoritative" doctrine —although the reader may readily do that for himself, if he likes. By having heard those authorities a little we have found some useful conventional words; and the reader is perhaps convinced that it won't do to take some of such authoritative "knowledge" very seriously.

———

CHAPTER IV. *Statement and proof of principles of language; or, Logic.*

§22. a. We now begin definitely to observe facts, each for himself. I simply point out the things the reader may look at, as a means of seeing the truth for himself. What I write is a sort of guide or sign-board; it is not the truth, but merely a particular expression of the truth—certain symbols that point to the truth.

b. It is an evident truism that if the reader is to use solely experimental evidence, and is not to make the really impossible attempt to substitute this present symbolic guidance *for* the truth, then I can not permissibly make *any assumption* as to a real truth or fact, from which I can "start." If I were to say that 'In the beginning God created the Heaven and the Earth,' or 'In the beginning was the Word,' then I have assumed the truth or reality of everything about those extensive subjects I cared to assert, regardless of whether or not the reader could see and verify it for himself; and the assumption is obviously used as the answer, or absolute explanation, of any problem that is proposed. Obviously there always would remain the problems:- Why is the assumption true? and What was before the assumption that made it true? and Just what does the assumption *mean* anyway? What actually *is* the "beginning," and the "Word"?

c. Therefore, in this book positively no essential or qualitative assumption is made: everything is based directly on the reader's seeing for himself. However, it is not possible, in my writing this symbolic expression (or guidance as to which direction the reader may look), to avoid two general arbitrary, quantitative, or formal assumptions. For if I am to write and have the writing actually guide, I must formally assume:- (1) that both the reader and I can and will use a certain sort of *agreed upon* symbols or language; (2) that those symbols *do* point to something for the reader to look at. —— In this section we examine those 'assumptions' in more detail, it being shown that they are arbitrary and not real.

d. The first assumption is simply that the reader and I both speak English. Obviously, it is not essential in any absolute sense that we do. It simply is:- that *if* we wish to communicate, *then* we both must speak English (or any other mutual language; the book can be translated into other languages for other readers without greatly modifying its present pointings). So obviously, that assumption is not real, but is a mere temporary and mutual agreement.

e. But that arbitrary assumption contains one corollary or implication that is important, and which we need to keep in mind. 'To speak English' [or other language] means finally that *if* we say *A* is *A*, *then* we must not undertake to say that *simultaneously A* is *not A*; for to do that obviously destroys at once what we say—and we then are not speaking any langauge. That implication of the assumption is still obviously arbitrary; for it says that *if* we agree to use certain words for certain things, *then* we must keep the agreement *until* we give notice that we shall change it. It is not an assumption in any real sense; for it is an obvious and commonly accepted fact that (1) many people do not speak 'English' [i. e., any language] (infants, e. g.), and that (2) some who do speak 'English' will consciously and deliberately fail to adhere to such an agreement (are liars, in short), and further that (3) a number who try to keep the agreement have such poor memories or nervous systems that they fail to do so. The agreement is usually referred to by the phrase, "having the same definitions." But we are going to see, as an immediate implication of the principles of time and space, that two persons can not have quite the same definitions (§§36, 57, 64, 158; cf. 66): and that even after I carefully make a definition it is impossible that it be accurate (Index, s. v. "Exact"), so that it is absolutely impossible for me to adhere *strictly* to my own definitions. —— Our examination into the language trick in this chapter will show those facts about "definitions"; we have had here a summary statement of why there has always been so much difficulty over "definitions"—the difficulty is a quantitative matter. Therefore, I have put our arbitrary agreement as to language into an explicitly quantitative form, and we shall see repeatedly, in further detail, that it is not a real or qualitative assumption, but merely the base of the invented language trick.

f. (2) Our second assumption, when we talk together in this book, is that I am talking 'about something.' In short, the minute I begin to use these verbal symbols then I have tacitly assumed that *the universe exists.* Now, clearly, that assumption is substantially the same, at least in form, as saying that 'God exists, and his existence explains everything'. It requires a little keen observing to see that this second assumption is also formal, and not real. We shall see it in general in the remainder of this section, and more explicitly in §§60, 93, 161 (also, see Dewey's treatment of it in his Introduction). The assumption may be called the *existence assumption*; the philosophers discuss it under the names "being" or "Being" or "substance" or "ontology." In actual effect, this total book is required to show and does show, that it is not a real assumption.

g. We obviously correctly write the existence assumption thus:- '*If* we speak English, *then* at that time we tacitly assume that something exists, goes on, acts, or happens.' —— Well; we can see as a truism that if I had made a real assumption there, then it would follow that if I had not written the book the universe would not exist; or, I really saved the reader's life by writing this book, as otherwise he would not "be." That conclusion is clearly absurd. So it is obvious that I am merely *formally* assuming the existence of the universe. —— What actually happens, stated in a commonsense and ultimately rigorous way (as proved by this whole book), is that I write, and in writing I describe the formally-assumed universe; and the reader looks at it—whatever it is,—and *if* he sees it there, *for himself*, then the universe is experimentally and verifiably demonstrated *to him*, and my formal or arbitrary assumption for the purposes of this book was merely a *tentative*—i. e., not generally essential—way or method or trick used in guiding him to see.

h. But that commonsense way of showing that I have made no real assumption does not *explicitly* satisfy various sorts of agnostics and irrationalists (§32c). They often even definitely ask:- "What *is* this universe you take for granted you are talking about? and where does it come from and who made it? and how?"; and assert that unless I answer those questions intelligibly then I have made a *real* assumption that there *is* such a thing as the universe when I start talking about it. Again, the same commonsense way of answering is, that in this book I do give verifiable answers to those questions, and that further I show experimental, verifiable proof that those answers are complete, and that nothing more or further—in a qualitative way—could exist as an answer. Hence, the book as a whole again is proof that my assumption is formal.

i. But those commonsense answers do not content the technical objectors. As we shall discover (§35cd), actually the only final way or real way to prove anything whatever is to do it or make it or produce it ('observe' it or 'experience' it, all that being merely the ancient wisdom that the proof of the pudding is the eating thereof)—and that actual way is the one we use in this book for all final or

rigorous proof. But those objectors want an explicit technical statement which rigorously *expresses* proof that our existence assumption is not real. So I give it in the next paragraph; but they will have much difficulty in understanding it at this point, as the understanding requires a grasp of the whole book. The actual fact, which causes the difficulty, is that the objectors' questions do not ask any real question; the questions are wholly meaningless, or self-contradictory. The reader not interested in technical word juggling might well skip the paragraph, in which I answer those word jugglers.

j. I assert the formal assumption that 'something exists, or goes on, or acts, or happens, about which we speak when we speak English.' We can arbitrarily consistently use that form, and rigorously and intelligibly describe and prove everything, without *really* assuming it. Each of the readers using that formal assumption will then get the *same* meaning as to what the 'something existing' *is* or *is not*, *regardless* of *how* he considers it for himself: i. e., he can say that 'it' is everything or nothing, mind, matter, God, consciousness, ideals, real, unreal, truth, lies, dreams, life, death, Nirvana, heaven, hell, static, dynamic, or any one of millions of possible mere *names*; *and then he will still*, obviously to all the other readers who will adhere to $A=A$, *mean just the same that each of them does*, regardless of the fact that each *may* actually have used a different name (or "Being"). In short, I assert that this book, by using that formal assumption, will get for each reader the same meaning, regardless of what he says '*it*' "really" *is*. That is the explicit assertion of what I formally (and at least, necessarily tacitly) assume by the very act of writing this book (*every* book tacitly makes the same assumption—and every speaker of a sentence). —— Now, the explicit proof of it is:- It appears as a truism, from the very agreement as to the primary use of the 'English' [any] language, that the 'existence assumption,' whatever it is, is absolutely and rigorously *un*expressible in any positive or actual words, as *no provision for such expression is made by the agreement.* (As a further fact, which the reader may verify by personal trial, or which is made to appear implicitly by this whole book, no such provision for that expression—the expression in words or 'English' of a *real* assumption which has any *positive*, actual, or intelligible meaning—can possibly be made; see the remarks on the ineffable, §56.) Consequently, as a truism (which truism was asserted to begin with: and the fact that there *is* this observable truism, or obvious "circle of reason," is the absolute verbal proof—cf. §35), in no *expressible* sense is that assumption a real assumption; consequently, it must be merely a formal one, or an arbitrary, temporary one. And as a part of the same truism, the agnostic questions quoted in par. h also fail to express any real question; or, this is a formal, technical solution of the problem of Being (put in a negative form: as stated above, the whole book is needed to give the positive, really useful form).

k. Well; if the reader did not skip, he probably finds that he does not care for those verbal gymnastics. I do not care for them myself, because they are not very useful; for such formal expression of proof is generally unintelligible to the very objectors and word quibblers who demand it. That proof is the only such a one given in the book; I put that one in because I have found that it is often demanded by impatient persons who do not know just what they are asking for. Such "proofs" do not convince. That one is rather obviously a sample of the customary uselessness of mere verbal "argument." It is really a very brilliant "argument." But there is no room for that sort of stuff in this book.

l. It may be held that if the reader is to observe for himself, then I am tacitly making a *real* assumption that he is *able* to observe—or, more generally, that man is conscious; or, "I think, therefore I am." But that assumption that the reader can observe is obviously included as a part of the formal assumption that the universe exists (the reader is part of the universe), and hence like that existence assumption is arbitrary. As a matter of actual practical fact, that formal existence assumption includes *any* assertion which I wish to call to the reader's attention *for his personal verification.* Any non-dogmatic book or sentence makes the same assumption, and leaves the verification to the reader or hearer. In practice, I simply refrain from pontifically asserting that anything is *so*: the book lets the reader assert that anything whatever is so or not so, just as he likes to say; and if he will then stick to that verbal agreement, that $A=A$ can not simultaneously be A *is not* $=A$, the book proves that his further conclusions, verbally consistent with that assertion, give him absolute knowledge, and knowledge that essentially coincides with all other persons' similar knowledge, regardless of how differently they started *verbally.* —— It of course sounds odd to "start" without starting *from* something—without "assuming" something. But the total book will be concrete evidence that it not only can be done and is done, but that ultimately no other sort of "start" is possible (otherwise, how could any baby possibly start learning?). *Valid* logic or language or expression is *circular*, and can not have a *real* "start" (§58j)—any more than a circle can.

---

§23. a. In order to clear the field of traditional obstructions, so that the reader may look at things as they are and make his own discoveries, I begin here and destroy the traditional logic—the logic given in the usual texts, which for convenience I frequently refer to as the classic logic. That logic is essentially dualistic (§24c), and I hence also refer to it as dualistic or pluralistic logic. And as doctrines conventionally written in texts are ordinarily tacitly claimed to be "logical," and the logic is wrong, it obviously follows that insofar as such books really are "logical" or "rational" they too are wrong. Some books tacitly admit being "illogical" —"Alice in Wonderland," etc. And some few (perhaps less than a dozen) rather clearly repudiate classic logic:- Christ's remarks, Dewey, Richard's theory, Jordan, etc. (§49op, etc.). But by the destruction of orthodox logic we clear the field, formally at least, of most printed doctrines or theories.

b. I said that I shall destroy the classic logic. To speak more accurately, I shall complete that logic. But as the completion contains the conclusion that the beginning of the classical logic—its foundation—was not only positively wrong and precisely opposite to the real truth, but that the logic was also useless for any directly practical purpose anyway (and actually never has been so used), then perhaps it is permissible to call it 'destruction.' However, the reader ought to name that process what he judges best; I shall name it destruction or completion according to the context.

c. We may trust "The Encyclopaedia Brittanica" (xvi, 879) to state orthodoxly the essentials of that classic logic:- as being "the science of the processes of inference,"—"inference" being "the mental operation which proceeds by combining two premises so as to make a consequent conclusion."

d. The obvious, commonsense replies to two commonsense questions at once destroy—merely destroy—that logic:- (1) If the truth of one or more premises can be observed directly, why can not the truth of the conclusion be observed directly? Clearly, if we take a classic example of "reasoning" or "logic"—such as "All men are mortal; Socrates is a man; therefore, as a conclusion, Socrates is

mortal"—it is just as easy (actually more so) to observe that Socrates is mortal as it is to observe that all men are mortal. Hence, such "logic" clearly does nothing which can not be otherwise done. So there is obviously no need of adding a useless thing like "logic" to our burdens. (That is an ultimate or absolute view. The actual temporary usefulness of orthodox logic was that it was a tentative trial which, though it turned out a failure itself, was needed as showing *how not to do it*—a bit of experience essential in practically all cases.) (2) The second question is:- If the two premises are two distinct or separate entities of some sort, not connected in any way (as is explicitly implied by the encyclopedia), then *how* can they be combined? and if they are already combined, then why say that they are to be combined? Obviously, the orthodox definition of logic substantially asserts that the premises are absolutely separate—are dualistic or pluralistic. In that case the assertion by that logic that it then combines the premises is self-contradictory and self-destructive:- it says *A* is *A* (premises are absolutely separate), and that *A* is *not A* (premises are combined). On the other hand, if the logic means that the premises are not separate, then they do not need to be combined, and there truistically exists no such thing as the logic which does "combine" them. —— In point of fact, this second question, which promptly shows the absurdity of any such thing as "logic" or "reason" being said to exist at all, is vaguely in the minds of most thinkers nowadays; and their answers to the question are not the brutal showing of the orthodox contradiction which I have just given, but an assertion of agnosticism.

e. This paragraph is a slight digression:- When the contradiction is thus dodged by asserting agnosticism—by asserting:- "I do not know"—the same contradiction merely bobs up in the next step. (That is well known; but I may briefly write it out in this paragraph.) If the agnostic asserts that the truth of no premise can be observed or known —that we can not *ultimately* know whether the universe exists (even though its existence assumption is formally rigorously demonstrated for him in §22j),—then as an obvious truism he has no consistent right to assert the first definite premise or assumption of the classic logic:- that two premises can be combined—or even to imply thus that a *premise* can *exist*. A man who does not know can not consistently make any assertion: to do so is to contradict himself essentially—to say *A=A* and *A is not=A*. He can not even assert that he does not know, for then he would be asserting that he knew at least one thing; and it would then immediately become necessary, according to the classic logic, that he prove from that *one* premise, by using another which he asserts does not exist, that he has no other—knows no other thing. And it is obviously impossible—i. e., essentially self-contradictory—to do that. In short, the customary assertion of agnosticism promptly destroys both itself and the classic logic at the very first step. —— The agnostic by asserting agnosticism thereby asserts that he *knows* one thing to be true. That promptly makes him in effect agree that he observes—and tacitly admits the properness of the existence assumption of the last section. —— I complete the explicit qualitative principles of agnosticism—or rather the showing of the complete lack of any valid principles—by referring to its variation called irrationalism, the technical synonym for *cynicism*, in §35. But throughout this book it is shown that *qualitative ignorance* is impossible—the *expression* of qualitative knowledge and *definite* consciousness of it is a different matter, which is being explicitly treated in this chapter, and will be finally fully considered in §150. And any absolute or exact *quantitative knowledge* is also impossible (Index, s. v. "Exact").

§24. a. The last section shows the fundamental self-contradictions in the classic logic, thus merely destroying it. In this section we examine that logic more explicitly, and see its completion into one form of a valid logic.

b. If the two premises actually be separate, then obviously reasoning consists in combining them. I. e., reasoning consists in *creating* (out of nothing—as nothing is supplied by the classic logic for the purpose, as can be seen by referring to the conventional statement of what that logic is, in §23c)—reasoning consists in absolutely creating a link between two premises, so that the two *and* the link all join together into one—that creation "causing" the "consequent conclusion" or that joined-together one. I am unable to conceive anything's being created out of nothing—even an idea as being created out of nothing. The assumption of such a creation is saying *Nothing=Nothing*, and then at the same time, *Nothing=Something*, or *A=A* and *A is not=A*. Certainly I never observed any such process as creating something out of nothing, and no one has ever submitted any verifiable evidence that he observed such. But let us verbally and *formally* assume that an idea, or that connecting link just mentioned, *is* created by reason or the classic logic; and then let us see what happens, in strict agreement with the orthodox method of that logic:- By the conventional description of that logic we have definitely that the link did not exist before it was created. Hence, it is at once a mere truism that the creation of the link must also create the conclusion, and that the conclusion did not exist as fact or truth before that actual creation. Therefore, by classic logic, before formal science was "reasoned" out, the universe was chaos and the sun didn't rise—which is glaring nonsense. What science does is merely to call men's attention to certain things: they look, and a part of those things actually becomes a *perceptible* part of their nervous systems or minds (see Chapter XVII, on psychology),—or their minds or nervous systems *grow* as a result of observing, and nothing is *created* (§§98p, 120h, 144, 146, 166). —— Therefore, we observe that the classical logic will invariably produce a nonsensical conclusion—as shown typically in that conclusion about chaos. And we use that observation as one premise; and following strictly the rules of classic logic, observe and use as a second premise:- that the classic logic is claimed to exist—or to be not self-destructive. Then from the two premises—viz:- (1) the classic logic destroys its conclusions (i. e., gives nonsense), and (2) the classic logic is not self-destructive or does not destroy its conclusions—we deduce (as a truism of our verbal agreement not to contradict ourselves) that there is no such thing as the classic logic or reasoning. —— All that—necessarily long-winded in order to be strictly "logical"—shows nothing more than the unescapable contradiction in the One and the Many. The classic logic merely shuts its eyes to it. We may readily see just how it arises and how to dispose of it, by observing the classic logic a bit more in detail:-

c. Obviously from the last paragraph, classical logic is a dualism—there being always in its forms one thing (premise) separate and distinct—*exactly* and *sharply* apart—from a second thing (premise). *All* doctrines based on that logic (i. e., conventional science, philosophy, and religion) are hence truistically dualisms: or, are technically *finite* pluralisms—for the possibility is tacitly indicated by the conventional description of classic logic that there may be more than two premises; but obviously by that description there must be a finite number because that logic requires *explicit* statement of its premises and only a finite number can be explicitly stated—that being a truism (or, for full discussion, see Index, s. v. "Infinity"). And as a further truism, a *finite* pluralism may always be reduced to a dualism; and as a

matter of commonsense fact, the classic logic itself takes its final dualisms—whatever they are in the hands of its different teachers—and always unites the pairs into a One: an example was given in §20e. However, classical logic does not *explicitly* agree to that commonsense fact, but takes one premise and another premise and relates them by what is actually a third thing or entity—that third entity agreeing definitely in character with Descartes's and Aquinas's and the Catholics' God, and less definitely with the God of all other doctrines or philosophies that use the classical logic (i. e., those others are with more or less explicitness beginning to break away from the use of the classic logic and agree with Christ). Or, the third entity constitutes whatever it is that dualistic systems (§§19, 20e) vaguely and surreptitiously mention as "relating" the "opposite two principles." —— We may note an incidental but somewhat important truism in all that. We can see already that strictly speaking, even formally or verbally there is no such thing as dualism:- for that third or relating entity is alway put in in some way, and that makes *three* things at least—and not two. Therefore, all so-called dualisms are actually some sort of attempted finite pluralism which is at least a 'trinity.' But in verbal agreement with conventions I shall continue to use "*dualism*," merely noting here the careless way the classic philosophers had of bandying words.

d. Obviously, the classical logic has, in its historical "systems," used such a third, connecting link, even if that link was no more than a formal word, such as "*relationship*." And clearly, as a truism, if the premises are such sharply distinguished, separate things, they can not be joined —or "related" together in some way—without some link; for if the two things were *directly* joined together they would lose their essential character of being sharply distinct. But then we immediately see that this link or third entity itself, by the classic logic, needs a link on *each* side *of it* to join it to the first two things. That fact has frequently been observed in the past (it is another mere truism of the logic's original assertion of absolutely separate things); and its observation is definitely the cause of assertions that pluralisms were truth instead of dualisms. But we saw in the last paragraph that those pluralisms were formally finite; also, they were exceedingly vague as to *how many* things they contained—although classic logic demands sharp, distinct things. However, for the pluralists to have been explicit about *how many* would have destroyed the classical logic. For if we really observe what we are doing, and become explicit about it, we see that, just as the first link needed a link on each side of it to connect it, so those two links in turn need a link on each side, and so on ad infinitum or in absolutely *infinite regress*—making thus an infinite number or *never-ending* number of entities. Thus by rigorously using the classical logic we derive an *infinite* pluralism—which is sound or valid (the "truth"), as we shall also see in simpler and more direct ways. But 'infinite pluralism' means 'unmeasurable pluralism,' or 'unnumbered number-ism'—which phrases or names are explicitly verbally self-contradictory. Clearly, unnumberable or uncountable pluralism *means* a *continuous* connection of things: for we kept on multiplying those links in infinite regress until they necessarily became continuously joined—for if we went to absolute infinity those links would necessarily use up *everything* in the universe and the last ones would become zero, which truistically means that there is a continuous joining. So the classic logic's rigorous conclusion as to what is truth contradicts its base:- that there were separate and distinct things. But this time its conclusion is obviously a verbal or formal self-contradiction:- 'unnumberable number-ism,' or 'infinite pluralism.' That conclusion obviously means either a continuous universe, or else one absolutely divisible into an infinite number of parts of zero size—which at least are *not* "parts" of any distinct, finite, *perceptibly* separable size. (That is an odd looking conclusion, of course; but later we shall see that it can be readily handled when put into commonsense terms which merely say 'there is no exact science.') So when it is actually used rigorously, the classic logic gets the truth by destroying its base. Below we observe that in simpler, sounder ways.

§25. a. We may at once see some important facts. The classic logic's premises are not absolutely separate, in the ordinary sense of the words. Consequently, they are already together, and we can, as a truism, observe conclusions in essentially the same manner that we observe premises. Therefore, there is no such thing as logic or reasoning in the conventional sense. In the end we shall see that reason is simply what is called consciousness (XVII); and is, in more explicit terms, mind or intellect as *verbally* distinguished from emotions. But emotions are a part even of that sort of actually-existing reason. Man is not at all a "reasoning" animal in the conventional sense. A number of very useful implications are contained in that general fact; we shall see them in detail throughout the book.

b. As the classic logic will, and does, come out right if it be definitely taken as far as it will go, it is an obvious truism that in the past the best philosophers and prophets and seers and scientists have been *implicitly* right. If we see what they meant, even though they did not say it with rigorously explicit verbal self-consistency, then we see that they were essentially right. As a matter of fact (the detailed proof of which will appear from time to time), if we take into account *all* the causes of anyone's saying anything, we see that no one can ever make an error: *man can not make a real error*: to know all is to forgive all. A short rigorous proof of that is:- to say that someone makes a *real* error is to say that the universe—of which he is a part,—or natural law, or God, makes a mistake or is inconsistent—which contradicts the tacit agreement that "*universe*" means oneness or consistency. —— But actually, in practice, we restrict our vision and statements to just a part of the universe (§28c); and in that restricted part of it, a man may obviously get out of agreement, *as a man*, with his somewhat immediate environment, however right he may be in a wider sense. We can not actually see *definitely* all the universal details one by one, especially in the limited time of a human life; and that fact is at least tacitly agreed upon when we say that someone makes a mistake, or is wrong. Consequently, when we use that practical or quantitative, restricted way of looking at things, and observe the actual historical context of the classic logic and the explicit expression of the doctrines that use it, then it must be said that *explicitly* they are wrong.

c. But that is only an intellectual or partial conclusion. *Implicitly* they are correct, and the actual fact is that men have usually correctly understood them in a general way. Often hereafter I sharply assert that some conclusion is wrong. But I show that it is wrong from only a partial point of view (usually the everyday one): my sharp condemnation is only intellectual, and I ask always to be understood as meaning that I know that the total of the matter is beautifully consistent and right. Even the classical logic is right ultimately. And even the late Kaiser's paranoiac exaltation of his rather trivial, short-sighted self exhibited the strict consistency of natural law and his own right agreement with it, *provided* we go back centuries and view the accumulating Prussian aristocracy that, so far as he personally was concerned or responsible in his relatively short life,

merely happened to focus in him. But obviously, in daily life if we say something about the former Kaiser we can not stop and go through with all that lengthy prologue. Usually we simply do not think in terms of centuries and of space that includes galaxies.

d. The ultimate fact, anyway, as we shall see when we examine the infinite regress we saw the link go into (§§40-2), is that we can not make an *explicit, accurate* statement.

§26. a. Having thus fundamentally destroyed all orthodox teachings *in so far as they pretend to be explicitly rational expression,* we can now look unprejudicedly at things as they are, and as a child would. And we can discontinue the use of that tiresome, scholastic classic logic. I used its own weapon to destroy the classical "reason"; but it is a poor, overweighty, clumsy tool.

b. A child sees things joined together—sees them as being continuous. He does not at first understand how to 'take' things as being "apart" or separate, so that they may be readily counted one by one. The reader can substantially verify that by watching a child *learning* to count, noting that at first he fails to distinguish the things he is counting as being "apart" from each other. —— I am now beginning to formulate explicitly the verbal trick of language—the trick of saying things,—which is to replace the defective classical logic. That trick is the basis of the discovery of what is positively the whole truth. It will appear that although some of this may look like "philosophy," it is actually experimentally verifiable. In anticipation of the detailed showing of that, I may state that I first began to get at the valid language trick by carefully watching a child learn to count, and trying to see what it was that made it such a slow, difficult process for him. The process of counting is the basic form or invention of mathematics; and mathematics is merely generalized or simplified language. We adults know how to count so well—are so skilled in the use of the trick of mathematics—that we have to watch a clumsy learner at it to see the method.

c. If it is not convenient to watch a baby learning to count, or if the reader prefers to observe actually in himself that we naturally, "truly," or with "commonsense" observe things as continuous or joined together, then he may readily do the latter, thus:- If he observes (say) Chinamen, at first they look practically alike to him. After he gets accustomed to looking at them he can distinguish them apart, and see readily that they have as distinctive "different" features—"separate parts"—as we have. The essence of the experiment is that the reader observe something unfamiliar to him: he then sees without the prejudice of preconceived ideas, and he sees better what it actually is, with the details of parts merging continuously into each other.

d. And that fundamental observation which we make is one way of noting the fundamental principle of science:- continuity (or unification or relativity). "Conservation of energy" is a phrase that means that energy *exists* continuously. Or, scientific continuity means that there has been observed a continuous, unbroken (unseparated) sequence of events—whether that is named *cause and effect*, or by some other pet phrase. We have actually had to learn to distinguish things "apart." The way that distinguishing is done by us humans is with convenient arbitrariness based on the velocity of the light that perceptibly affects our eyes: we do not *have* to do it that way, for by using suitable tools we could divide things differently (§§77fg, 83, 100, 136; XIII).

e. Therefore, when we look at the universe, at first it seems joined together and not separated into parts. —— Usually conventional science, as its last conclusion and its formal end, gets the law of continuity. We are here going in just the opposite direction, and *beginning* with that, simply as the first, "commonsense" observation. It is merely a fresh point of view. Valid logic is circular (§58j); hence, we can start backwards and use our eyes then without interference from remembered dictums.

f. With practice we learn to separate the universe into parts, as stated in par. d, and as we shall see in "concrete" detail in Part Two. Here we are observing words, and noting how *they* are used to refer to or "express" those parts. And we have seen that when we get practiced in separating the universe into parts we forget how it at first was continuous. We simply get out of the practice or custom of seeing it as joined. So obviously this whole book is essentially recalling to the reader's memory something he already knows. He most likely has never put it into words of any sort; so the words that have to be devised for this book may in some places look a little odd at first, especially along here where we are using words to discuss an investigation of words.

g. Consequently, to our sophisticated eyes and unprompted memory the universe has rather a self-contradictory appearance:- sometimes it seems continuous and sometimes it seems separated into parts (the things we are very familiar with seem so emphatically distinct as to be almost "sharp," "exact," discrete things). Obviously, the "problem" of the One and Many arises with the first observations made by a baby. He does not "express" the problem and its solution—the whole thing being obvious and simple to him, whose mind has not been tinkered with by Aristotle, the theologians, etc.

§27. a. And that seeming double aspect of the universe as being the One and as being the Many can be at once observed to be shown or reflected both in the meaning of single words, and—more explicitly—in the meaning of sentences. First we consider single words:-

b. A single word standing alone is simply a symbol: i. e., the word indicates or points out to us a meaning which we have mutually previously agreed upon. The word, just of itself, has not that meaning; it is itself obviously a visible design or mark or collection of ink, etc.—or if a vocal word, is a combination of condensations and rarefactions of air, etc.

c. A single word does not, just of itself, have what we might term a *positive* meaning. E. g., the printed word *Oh* substantially has no meaning, because only by the tone of that word when spoken can we determine any particular meaning: and just the single word *bay* (no context) might mean a color, or an arm of the sea, or a sound made by an animal, or a part of a building, or the state of having to face an opponent, or might have several more old-fashioned or "obsolete" meanings and local or slang meanings. Therefore, a single word has a positive meaning only when we tacitly or otherwise agree that it means a complete sentence. With the understanding, then, that single words are agreed to imply some explicit sentence, we shall observe them.

d. We may note that there are three sorts of words, if we consider them from the point of view of their meaning:- (1) There are words which name parts, and hence imply that the universe is separated, or is made up of parts, or is the Many. (2) There are words which name combinations or unifications of those parts (such as the words *universe*, *all*), and which hence imply that the universe is continuous and not split up, or is the One. (3) And there is a third class of words which are used to assert in some way the joining or that which relates the Many together, so as to form a One. —— From the point of view of meaning there is another sort of words, which are named interjections (such as *Oh*). Those words *formally* have *no* meaning, as noted. When one is used, it obviously means nothing positively and is then

not a word in the usual sense; or else it must imply in its particular given usage one of the three meanings mentioned.

e. Grammarians name other sorts of words; they distinguish sorts according to the structural usage of words in a sentence, which usage is not directly dependent upon meaning. There are any number of ways of sorting words:- into lists depending on initial letters, which the dictionaries use; into classes depending on the number of letters, or of syllables, or by whom used, etc. Those ways, and our way according to meaning, are merely convenient—i. e., arbitrary and not essential. We shall see that no classification of anything is in any way absolutely essential; i. e., we can classify or divide the universe or any part of it as we please, depending on convenience (that statement is equivalent to the one about the velocity of light in §26d, and includes the theory of space and time, §§36, 57, etc.). —— In the grammars one word is sometimes one "part of speech" and sometimes another, and sometimes in a given usage is not positively any certain part. Precisely similarly, we are going to find that when we divide words according to meaning the same word may be used as any one of the three kinds (§§52, 44); and sometimes in vague speech its sort is not positively determinable. —— In brief, even after we classify anything, it is, as we shall see, a general principle that the classification is *never* exact or fixed. In no case do I ever intend to mean that any classification which I make is sharp, absolutely accurate, or fixed in any essential way. —— Much of this paragraph is an anticipatory statement, given here to let the reader know what to be on the lookout for as we further observe words. In the next section we take up the three classes in more detail.

f. Although explicitly I have been saying '*words*,' obviously we may include whole phrases or clauses in the same classification into three sorts. E. g., if I say 'this sheet of paper,' the phrase is clearly a single name for but one thing in the universe. Therefore, it is to be understood that when I use '*word*' with reference to the language trick, I mean a symbol that may be a single word, a phrase, a clause, or a sign such as *A* or *L*.

§28. a. The first class of words mentioned in §27d—words which name parts—consists usually of nouns and pronouns or their equivalents. Those words can name (1) just one definite part of the universe, as 'this sheet of paper'; or they can name (2) a part or "class" which is usually considered to be made up of parts itself, as 'men.' But 'this sheet of paper' may also be considered as being made up of parts —of atoms, e. g. So there is no real distinction as to the sorts of words in this first class which consists of names of the Many. —— I shall refer to words in this class as 'Many' words, or 'pluralistic' words, or 'scientific' words. They are scientific words because when *scientific* is given an explicit meaning it refers to the *formal* treatment of the universe as made up of arbitrary parts (§85).

b. The second class of words—those which name combinations or wholes—is also usually made up of nouns or pronouns (or equivalents). They name the One, and hence are conventionally known as "absolute" words; i. e., they are considered to name *all* there *is* to name, and truistically they are absolute, as there remains nothing else to name. Some words that are usually absolute or One words, are:- the One, universe, all, complete, a-perfect-anything, an-absolute-anything, everything, an-accurate-anything (meaning really accurate or exact), infinity, zero, nothing, none (the last three are *negative in form*, but are obviously absolute). However, practically any one of the words that are usually Many words may be *formally* used as a One word. I. e., at any time we may *formally* and arbitrarily consider that whatever it is we are talking about may be temporarily taken as the whole universe *for that conversation, or sentence*. Thus, in our equation $2+3=5$, the '5' is for the time being considered to be, and is, the absolute sum total of what we are talking about, and it obviously is *formally* a One word. In the past, that way of using what was ordinarily a part in a One sense, without being clearly conscious they were doing it, caused men to fancy that they did not know the whole truth. In this book, I simply call attention to that formal device whenever it is importantly used, and it becomes glaringly obvious that there are no qualitative problems.

c. Whenever any explicit name is needed for a word which is formally or logically used as a One word, but does not in ordinary meaning refer to the whole universe, I shall call that word a '*standard universe*,' or state that we are talking about a 'standard universe.' It is called a standard universe simply because we are using a word in a One form, as being for the time a formal universe, or a final verbal model or scale for that conversation, or a criterion, or a measure—and that is precisely what a "standard" is. —— Of course, I have not as yet shown the reader enough facts to make it positively intelligible to him that it is very important, if we are to see and think correctly, that we notice the use of One words, and especially the use of standard Ones or universes. It simply is requested that the reader keep these remarks casually in mind until their application is shown.

d. We see again that there is a *formal contradiction* between the One words and the Many words. That formal contradiction is ingrained in language.

e. But the language itself promptly—and with a rigorous, valid logic that we are now *explicitly* noticing—'corrects' or eliminates that formal contradiction of the first two sorts of words by 'making' and using the third form, *relationship words*. Those words, in meaning, assert that the Many are really joined together, and as such *is* the One. In short, Many words assert a splitting; and relationship words at once assert no-splitting, and thus *really* cancel any *formal* contradiction. Language itself is thus really and explicitly consistent, and there is a *double* contradiction in it which is self-cancelling. We shall see that fact more definitely when we consider sentences (§§31-4, 51).

f. There are several sorts of relationship words, and it is often puzzling to decide just how much of the relationship quality is possessed by a word in a given usage. As a rough general rule, conjunctions, prepositions, and verbs are definitely relationship words; they are obviously "copulas," or joining-together words. Intransitive verbs, such as *is*, assert explicitly the *ultimate* nature of a relationship:- *identity*, or absolute unification (see par. h below). Other relationship words merely explicitly imply identity. —— There is a sort of relationship words, which words are always making puzzles for us, because the implication of relationship is so remote in them. Usually they are what are called abstract nouns, such as *truth*. It is obvious that "truth" is not what is usually considered a part of the world; nor is it in its conventional meaning the whole of it, the One. It can probably be seen at once that "*truth*" is simply the name of a relationship:- to get the word we name all the Many we like, and explicitly connect them by a relationship which really and obviously exists, and then we verbally "*abstract*" or take away those concrete Many and give a name to that real relationship which we used to connect them, and *formally* seem to speak of it as either a One or a Many name:- *truth*. But obviously, the actual content of meaning is still *relationship*.

g. Usually, such abstract or 'relationship nouns' have considerable resemblance to One words. *Love* is a relationship noun or *name*, and we say 'All is love,' or 'God is love,'

where '*is*' verbally asserts an identity between a One word and a relationship word. But clearly, in such cases we mean that *all* the parts of the Many are joined together by a relationship named *love*, and as such is-are the One.

h. A relationship is obviously a joining together. If two things are joined together—*really* joined or connected in some way—they are, as a truism, a unit—or absolutely one, in some sense. E. g., if we say 'the book *and* the table,' if '*and*' is a relationship word that joins, then the book and the table merge together *without any real or positively ascertainable boundary between them.* (We shall see in detail in Part Two that such is actually, scientifically the case.) Consequently, *if we speak positively accurately* we are unable to say where the book 'ends' and the table 'begins'; hence, if we mention the book *accurately* as such, we have to include with it the table (and implicitly the rest of the universe). That is to say, the *real relation is an identity.* —— The reader possibly does not see all that for himself as yet; it is something that requires a large amount of evidence, and that is given only gradually as we proceed. But what is especially called to the reader's attention at this point is that there is really—in the ultimate—no sort of relationship but that of identity. And here is a formal statement of the truth of that point, simply as definite truisms:- Very obviously, if two relationships are named, the two can not be connected by a relationship word, for there is no relationship (or mutual action) between relationships. A relationship of a relationship is nonsense: e. g., what is the brotherhood of motherhood?[28h] Relationship, by all our implicit definitions above, is an indirect assertion of continuity; and if something *is* continuous or the One, it obviously, as a truism, can not be more One or less One. And that is exactly identical to saying that all relationship is identical ultimately, and hence *is* an assertion of identity. —— As we proceed, frequently I shall point out more and more clearly and in detail, that there is but one relationship—that of identity.

i. So, to summarize, there are One words, and Many words, and relationship words. Many words formally contradict One words. But relationship words in turn contradict Many words, and assert their real union as a One (without a relationship word's being the classical logic 'link'), and hence identity with the One. —— Therefore, obviously, the formal or verbal or logical contradiction is inherent in language and unescapable. But there is, in relationship words, a second—and hitherto not very explicitly mentioned—formal or verbal contradiction which eliminates all real contradiction.

j. Before proceeding to take up with regard to sentences that same formal cancellation of verbal contradiction (beginning in §31), we shall notice that precisely the same thing is evident in theology (§29), and in mathematics (§30). We may here observe, as another form of summary of this section, that One words, *especially standard Ones*, are merely what science calls classes, and attempts continually in a conscious way to make. In this book we shall see in detail just what classification is: existent texts are vague on that subject (for implicit authoritative agreement with that assertion, see "Ency. Brit.," xvi, 900-1).

§29. a. The race for many centuries has tacitly recognized the facts stated in the last section, in the guise of the theological Trinity. Because religion is the most important aspect of life (XVIII), men naturally gave those facts a theological name. In my opinion the men who invented the Trinity—it is a verbal form, or "invention," as we shall see—substantially solved all knowledge, and got the same solution as this book. And as that was done centuries ago (nobody knows just when), the reader will probably agree that there is essentially nothing novel here. The chief difficulty connected with the Trinity seems to have been that the priestly intellectual aristocrats promptly started confusing it with various historical happenings affecting their special privileges or graft, and the rest of the people stupidly and weakly submitted.

b. At this point I merely mention the outline of the Trinity:- (1) God the Father corresponds to the One. He was consistently the summation of all things (apart from the priestly exploiting, of course). (2) God the Son was a sort of emphatic symbol for Many words. As a truism, there could be no absolutely unique God the Son; there were God the Sons. But we have already noticed briefly the similar difficulty that arises from standard universes (§28bc). Historically it seems that Christ was first made by people rather definitely simply into a *standard* One—and when that fact was then afterwards overlooked, the Trinity obviously became nonsensical. Christ himself seems to have intelligibly and intelligently held that he was one son of God the Sons—a unit of the Many (§§160-2). (3) And then, to unify the God the Sons into or as God the Father, there was the named universal relationship, God the Holy Ghost.

c. We shall take up those Trinity names for the One and Many form or language device as we need them. If any reader thinks that these merely formal aspects of our way of talking can be eliminated, he will find an easily read attempt to do it in Wells's "God the Invisible King." Wells there tried to "abolish" the Trinity as being merely a theological and useless term or name. And the observant reader can readily note Wells's own reconstruction of another formal Trinity, even while he was throwing away the conventional names. The orthodox theological Trinity, in which Christ is a sole, or *unique* God the Son, is of course self-contradictory autocracy, as is already broadly apparent, and as we shall further see (§§49, 160-2, etc.); is precisely opposed to what Christ probably taught; and is the basis of the aristocratic exploitation which the priests have practiced

[28h] The reader is usually puzzled by such a question, and by this whole subject of relationship, because he has been trained into the habit of being puzzled. All his life he has heard various species of intellectual grafters using relationships trickily to befuddle him (usually the grafters have long ago befuddled themselves, so that they are probably no longer conscious of being such intellectual exploiters). Many of us have given up in despair and let the befuddlement procced, so that it is difficult now to comc out of it. The fact is, as we shall see under religious psychology (§§153f, 162, 166), the observation of a universal relationship is a profound emotional experiencc. If the reader rcally grasps 'God is love,' or 'The Many is continuous,' or any other of thousands of general statements, he is much moved. All relationships are really identical and finally universal. Consequently, when some conscious or unconscious deceiver wants to move the reader profoundly he begins to fire relationships at him—abstract words, "high-sounding" words, "rhetoric," "oratory" which has little more sense than 'the brotherhood of motherhood' when coolly examined. Perhaps the most exaggerated form of that intellectual trickery is what in the present day is known as futurist literature and imagism, although the same sort of exaggerations under other names is perennial. If the reader of that is soft and flabby minded he is much moved; if he has a normally sound mind, but has not studied out the way such chicanery with words is accomplished, such forms more or less irritate him; if he knows the trick it amuses him—and also pains him that some people should try thus to destroy their own and their neighbors' minds. But all of us normally tough minded people still half-consciously struggle irritatedly against a too-obvious befuddlement of ourselves by such fraud with relationships. —— Consequently, when I here have to take up the subject of relationships explicitly and hence with obvious emphasis on relationship, the normal reader tends to go into the customary befuddled haze, and also to feel irritated and resentful towards me. However, the fact that I am showing the intellectual buneo man's game is fairly good evidence that I do not care to work it; and we shortly shall have old confusions cleared away.

for centuries (the same dualistic game under names other than Christ's was worked by priests and kings long before Christ was born).

§30. a. It has been asserted (§28bgh) that the chief puzzles men have had in the use of language were due to a failure to notice definitely the various kinds of words—especially to a failure to observe the character of a standard One, and the character of a certain sort of relationship words (abstract nouns).

b. Mathematics is an abbreviated language in which markedly different symbols are (*usually*) used for those three different sorts of words. Consequently, because all that is needed for consistency in using *valid* logic is (as we shall see more definitely, §§43-5, 58) the proper recognition, or consciousness, of the different sorts of words, it follows that mathematics is an easy, useful, safety-first language because that recognition in it is automatically provided for (usually). In short, mathematics is simply a language that is much easier to use *consistently* than ordinary words, because in using mathematics it is far less necessary to keep our wits about us. —— Orthodox mathematics has some defects which make it very puzzling. In fact, it is impossible to understand much of it (the calculus, e. g.) as it is orthodoxly *explicitly* written: I have cited Poincare twice as asserting something which means that (Index, "Poincare," "Calculus"). So there is full justification for the customary horror of mathematics. I had it myself so strongly that I investigated them[30b] to see why I had it.

c. Mathematics was probably consciously first a science of number. I. e., all Many words were, in mathematics, represented simply by numbers: instead of saying "two boys" mathematics wrote 2. Afterwards, those formal symbols were increased by writing various other brief symbols, usually letters, such as x, y, a, b, θ, etc. Obviously, it is easy just to glance at mathematical language and pick out such Many words.

d. But orthodox mathematics may be said to be formally defective in that it has devised no symbols for One words that are readily and positively distinguishable from the Many variety of symbol. As we go along we shall see that the symbors for zero and infinity (0 and ∞) are always symbols for the One—although orthodox mathematics does not definitely recognize that fact (§§43-4, 55-6). But there are no other symbols in mathematics which are definitely distinguishable as being One words (unless various forms of integration signs be taken as indirect One words). Usually mathematical One words are standard universes, as the '5' in $2+3=5$. A device is usually unconsciously or intuitively employed by conventional mathematicians to distinguish such One symbols:- putting the symbol all alone as one member of the equation—as that '5.' We shall consciously employ that device in this book, in the few algebraic equations we need for brevity. —— But it is obvious that it would be a considerable advance in mathematics if mathematical books would, in some practically effective manner, positively distinguish One words. It would be an advance perhaps as useful as any since the invention of the calculus. We are going to see that our recognition of the fact that 0 and ∞ are *not* "numbers" or Many words is the practical rule or formal guidance we need in using valid logic (§43, etc.). That last sentence states the exceedingly easy and simple fact which all this detailed talk about words reduces to. The details are all so obvious that we know them without being clearly conscious of it, and I have to write at some length to make them conscious.

e. But there is in mathematics a definite sort of symbol for relationship words:- $\times$, $+$, $-$, $\div$, $=$, $\surd$, $\int$, etc. (An integration sign—that long *s*, meaning summation—is a relationship noun.) Obviously, those symbols are so distinctive that they are ordinarily practically automatically recognized, and hence are not—without almost an effort—confused with Many words or with One words. If a mighty orator with no real thoughts worth mentioning, or if some similar intellectual bunco man, goes into a rhapsody over *truth*, and dresses it up in shining armor, etc., soft-minded people fancy he is saying something, and are impressed. But if a mathematician were to do identically the same thing, and go into a rhapsody over his $\times$'s, and $\div$'s, and $+$'s, and dress *them* up in shining armor, he would be ridiculous even to the soft minded. —— The mathematician has not been wholly guiltless in the past of getting relationships confused with Many or with One words: those who take a space of anything but three dimensions very seriously are like that orator (§§59-62)—and the relativitists, unless they are definite about the form of logic they are using, are practically like that orator (§66). But obviously, mathematics has a tremendous advantage over ordinary verbal language in that it is not easy to confuse relationship words with other sorts, usually. —— And there is another automatic advantage of nearly equal importance:- All relationships, as we saw in §28h, are-is ultimately and definitely a relationship of identity; and in mathematics that relationship is the equality sign $=$ (or some logical or formal equivalent of it—often in practice given in a negative form, such as $>$, $<$, etc.). And obviously, all mathematics is an effort to use that sign *explicitly*. All other relationship symbols are evidently a step by step process leading up to that final *definite* assertion of identity. There is thus a very definite goal towards which a mathematical discussion is headed: everything explicitly goes towards getting some intelligible One on one side of that equality sign. That gives a tremendous advantage over ordinary verbal expression; for a discussion in words, because we are often so vague as to what ultimate relationship is, frequently omits all clear statement of what mental goal is desired, and naturally never arrives at any goal in particular —not even at a statement of just what good it is anyway to have truth in uncomfortable shining armor.

f. But mathematics is slightly defective in this matter of having distinctive relationship symbols, in that sometimes it uses letter symbols for relationships, that are like its Many symbols (*also*, figures and letters when used for indices or exponents are *relationship* symbols). Thus, d is usually the differential sign; f, the function—and there are other similar relationship nouns. It is a fact that mathematicians rarely do confuse a relationship letter with a Many letter symbol—except in the cases of L [length, or space] and T [time]; time and space are abstract or relationship nouns,

[30b] I apologize to the grammatical purists for my inability to consider such words as *mathematics*, *ethics*, as being always singular. Sometimes in my view I take them as being made up of various doctrines or branches, and hence grammatically plural. —— In principle, people with minds untrained in some appreciable degree need rather elaborate verbal inflections—glaringly definite grammatical signs of just where and how words fit in a sentence,—as a means (1) of forcing themselves to think definitely, and (2) of definitely guiding the similarly untrained hearer's otherwise unreliable comprehension. In so far as we are mentally keen we may drop such slavish formalities of inflection, and thereby gain fullness of thought coupled with economy in words (the characteristic of the largely uninflected English language which probably helps its continual spread). There must be a balance or compromise between no inflection and fulsome, barbaric inflection. Without further remarks on the subject I shall take it that the reader of this book is mentally not barbaric and hence likes to tolerate an occasional disregard of inflectional agreements which might be unpleasant to the more plodding purist who in effect considers it unsafe to give up a single inflectional crutch.

and in ordinary equational use are *not* Many words, but are continually orthodoxly taken to be such (IX). —— The fact that there *are* such formal samenesses is a rather positive indication that even mathematicians did not recognize just how mathematics had advantages over words. And incidentally, it may be noted that Newton, who invented one sort of calculus, seemed to know almost definitely the foregoing facts about mathematics and hence used a dot or dots over differentiated Many symbols instead of the confusing *d*—an insight which the German Leibnitz seems to have obscured ("Ency. Brit.," xiv, 540-2). (If the reader has forgotten calculus, or never bothered to pretend to learn it, then he has missed nothing appreciable by failing to understand completely that technical remark about a defect of calculus —and he is reassured that there are very few such remarks, needed by experts, hereafter. The remark just made is quite simple and intelligible if translated out of that mathematical jargon. But it isn't of sufficient importance to any but the mathematicians to warrant using the reader's attention on such a somewhat lengthy translation giving the full meaning.)

g. The disadvantage all mathematics have, compared with ordinary speech, is that they are not nearly so flexible in giving a definite meaning. That can at once be seen by noting that mathematics have but a few symbols for expressing relationship—probably less than a hundred,—whereas verbal language has thousands of such words—so many that the very profusion is a perplexity sometimes, although it always serves to secure an immense brevity *in putting across an explicit meaning* (because those thousands of relationship words replace verbal inflections—those inflections being language's original 'mathematical' way of automatically indicating relationship, as shown in footnote 30b: in short, mathematics is merely a primitively differentiated form of words). *But*, mathematics nevertheless achieves greater brevity with respect to the amount of space occupied or number of symbols actually used. However, that results because of the paucity of relationship symbols, and each such symbol therefore means *so much* that we take it rather mechanically and fail to get the real emotional content of a mathematical equation. The meaning *is formally* put over; but not with much emotional fullness or convincingness—in short, mathematics is not so flexible, as was stated at first. As we shall implicitly see in the chapter on psychology (XVII), if a statement fails to arouse some perceptible emotion it is pretty nearly a failure as a statement—as expression. And mathematical equations—i. e., mathematical sentences—have hitherto failed to arouse very much perceptible emotion even among first class mathematicians—who hence are "dry as dust," etc. Some of them go so far wrong as to assert that such absence of emotion is an advantage to mathematics. (Of course, if a man is so soft minded as to get excited, and fly off the handle, and run amuck like an untrained Malay, or a prima donna, because he has an emotion or so, then he had best avoid them; but the more of *controlled* or balanced emotions the better—§§149, 159). —— But perhaps the most convincing proof that equations are not so flexible as ordinary language is the fact that mathematicians use words to say just what their equations do mean.

h. There remains but little more to add to the description of mathematics, and that will be incidently done, chiefly in §§43-4, 55. The reader has seen in this section the whole of the nature of mathematics, except that possibly there is not yet enough direct evidence of the fact that 0 and ∞ are One terms or symbols. Obviously, there is nothing recondite or esoteric in valid mathematics that need frighten us. They are dull and dry and hence unpleasant if their nature is not understood. But ordinary verbal language is a great deal more difficult and complicated than mathematics: it is much harder to avoid incorrect and confused statement in formulating ordinary verbal language, or to understand it correctly and clearly when it is expressed to us. But the mathematics in the textbooks—especially the so-called higher mathematics—contains much confusion of One words with Many words, and in that degree properly is frightening, just as all "sin" or ignorance is repulsive.

---

§31. a. We have briefly seen the general nature of the valid logic by examining the equation or typical sentence, 2+3=5 (§12). We then saw some more of the details of precisely the same thing by observing the meaning of words themselves. In doing that with words, we actually were considering each word to have a meaning that implicitly was a "sentence," whereas the intended meaning of a word standing alone is frequently indeterminate. We are now going to consider sentences explicitly, and not merely implicitly.

b. When we definitely consider sentences we are going to see more precisely the same principles we have already seen several times. There is only one principle:- the universe hangs together, or works together. But there are an indefinite number of *ways* of stating that principle, and we are now coming to another way. In this new way we are going to bring in "time" and "space" explicitly—they being only implicit above. And simply because the things we are going to observe are things we all know, and know so well that we apply them all the time, the observations have never in our history so far as I can find been put very definitely into words. Hence, some of that description of the obvious looks a bit odd at first. But I do nothing more than show what logic the "man in the street" uses, and show that it is correct, and that I use it. Everybody who has ever correctly stated a valid observation has used it.

§32. a. A sentence is a collection of words which states a fact, an opinion—which states a *meaning*. That is the conventional meaning of *sentence*. Obviously, the words themselves are, as a truism of that definition, a Many which are-is actually joined together into a One called a *meaning*. We obviously have there our problem of the One and the Many, and an apparent contradiction—at the very beginning of speech or language. As we saw, if we have simply a list or assortment of words not thus collected into a sentence, the words themselves do not explicitly give any meaning or One. —— Usually the meaning of a sentence is a standard One.

b. Some technical philosophers, ordinarily named irrationalists, substantially refuse to agree that there is a "meaning" in any sentence or any of the universe; sometimes they merely say they do not know (are agnostic), but in effect they deny that a sentence can be made. —— Fundamentally, the non-technical person who asks "What's the use?", with the implication that there is none, is an irrationalist or cynic—as will implicitly appear from time to time, as I show what's the use (see Index, "Good"). —— Therefore the irrationalists assert:- "No actual sentence can be made." For us commonsense mortals it is sufficient to point out that their basic assertion or "principle" is a sentence, even if it is negative in form; and that therefore, truistically, those irrationalists destroy themselves as such by making a sentence to deny sentences. In the same commonsense way the sufficient answer to the person who asks *What's the use?* is to say that if he really believed there was no use of some sort, he would kill himself or at least refrain from his efforts to keep alive, and spare us the question. —— Hence, those irrationalists simply prefer to talk negatively; and it is obvious that, if we wished, we could add the symbol *not* to every sentence in this book and the meaning of the book

would remain identical, even if *formally* the meaning was "reversed"; the symbol *not* would merely change its present arbitrary meaning. As a historical fact, Zoroaster substantially reversed language that way (by giving his devil the name of his neighbors' God), with no change in real meaning. There is a contemporary example of language's reversing in meaning in the slang statement, "I should worry," which I am credibly informed means "I should not worry." —— In general, as we shall see from time to time, it is possible validly to reverse the *way* of saying or expressing *any* theory; the theory, in its reversed condition will continue to mean precisely what it did to start with (cf. Index, s. v. "Direction," "Ether"). The fundamental principle is that language is arbitrary: we can twist it around to say anything whatever verbally, and then *if we keep on consistently* or non-contradictorily expanding what we verbally stated, we shall end with precisely the same meaning that all others get, even though they may have started with a statement verbally the opposite. The general proof of that is quite simple and obvious:- the things themselves (the universe itself) to which the words or symbols point give the meaning to the words: the mere words just of themselves have no meaning; e. g., what does the word *zlqkebjf* mean? We may say that 'irrationalists' of all sorts are the people who take the dictionary too seriously. It is always painful to take *any part* of the universe too seriously, as only the One deserves complete attention (§163b).

c. The reader who has dipped a little into general science, or into philosophy or the different orthodox theologies, is aware of the historical fact that practically every sort of principle imaginable has been asserted and denied. I do not think I could formulate even the simplest, most harmless looking sentence on any appreciable subject without its being possible to find somebody, at some time or other, asserting in effect that he could observe that the opposite of my sentence was true. Those contradictory assertions are not confined to closet philosophers, and scientists. Just as soon as we make any kind of statement, some average man is likely to bear vehement witness that it is not so. A large number of average persons assert that there is no such thing as whatever it is the dictionaries designate as *evil* and *pain* and *disease*. Therefore, in the last paragraph, at the very beginning of the description of the valid logic, I considered what would be the result if we verbally agreed with the man who denied that there could be any such thing as a sentence —thus in effect denying, according to the ordinary usage of words, the possibility of any language or logic. We immediately saw that we would get precisely the same essential final meaning regardless of whether we started by saying "a sentence is" (sentences exist), or "a sentence is not."

d. The general conclusion of that discussion in par. b is that we can take *any* sort of statement which anyone cares to make, and get the same meaning for it by expanding it fully as I am getting from my present conventional way of expanding things. All I am doing is to take the most conventional way of verbally naming things. If somebody wishes me to start a complete and valid description of the universe with his own primary *verbal* assertion that the moon is made of green cheese, then I am quite able to do it—and get it right, intelligible, consistent. *But* the result *on language itself* would be that what we now customarily name "green cheese" would be green cheese of a considerably different history from that which verbally constituted the moon. In brief, it is a scientific fact that any substance is equal to any other substance, *if* the other substance be given a different age or time factor (including space factor, the two being "history"; see §§36, 57, 59, 60, 165). That is substantially a repetition of what was shown in par. b; the importance of the principle perhaps warrants the restatement in different words. —— So we have here, with *formal rigor*, once for all taken care of those who wish to say things in different words from ours. (We shall note the practical effects of such actual variations from time to time as we proceed.) There is no essential objection to their using such different words. It would result merely in changing the present ordinary meaning of words—would result finally in changing time and space implications of words into something different from present ones. The only objection to their making such changes is the inconvenience of them. Most words have a customary, fairly definitely agreed-upon meaning; and *insofar as the meanings are self-consistent* it is mostly a waste of time to change them—it is a trivial occupation pursued by the trivial, of scarcely more value than making an index for the dictionary. There is no essential reason why an *apple* should not now be named *balloon*; it merely is a historical fact, dependent upon many *now* imperceptible causes, that it has not in the past been so named. If an appreciable advantage could be shown to accrue from naming an apple *balloon*, we would, as a physical truism, so name it (proof in §98m). A simpleton could easily devise a new language by merely assigning each word in the dictionary to the definition of some other word—and people resembling that simpleton often write lengthy books.

e. Whenever words are taken so seriously as to be considered *essential*, then they have become idols—a part (a word) is mistaken for the whole; a unit of the Many for the One. We considered that generally in §14d. Because idolatry of words, *directly* considered, is so trivial, it is correspondingly hard to detect (is "subtle"), and hence rather prevalent still—as we shall frequently have to notice, because of the momentous indirect results of that idolatry.

§33. a. Hence, we have established the possibility of a sentence, which consists of Many words combined into a One meaning.

b. If we were to name *any* really isolated fact or thing by the word or symbol *THIS*, that word—which I am going to use frequently as a 'single' algebraic symbol—would obviously be absolutely unintelligible. The reader can observe the truth of that by various trials; e. g., if all colors were the same, we could and would name no color; for when we say *red* we mean or imply that something else is not red. Consequently, we must have a put-together or collected Many of words before we can talk and mean anything—for just one word will not (without at least *implying* others) say anything. Hence, the *THIS* (whatever it is to which we refer, or which we name, by that word) must be compared with something else, which I shall name *THAT*. (Clearly, whenever we say *THIS*, if it means anything, we have *at least implied* a *THAT* with which it is compared.)

c. That last paragraph simply gives explicitly the obvious details of the fact that we have several Many words in a typical or explicit sentence—at least two:- formally *THIS* and *THAT*. That is precisely the same fact which we saw relative to a machine (§§15f, 21b):- there has to be more than one part to a machine. In a real machine the parts actually join *into* each other by friction—just as was mentioned concerning the book and the table (§28h). A machine, *with strict explicitness*, is what is usually called an "organism" or an "organic whole." Similarly, as we see in detail as we proceed, language itself is a machine—is identical with a machine,—and the words themselves inseparably merge in meaning with each other.

d. When we say *THIS* we mean (at least implicitly) that there are a number of other things with which it may be

compared. If we say that *THIS* is *number* one of a series or assemblage of things, we imply the rest of an unending series of *numbers* or *names* of things with which it may be compared. And that introduces and describes the primary sort of mathematical words, *numbers*. Number is simply the *most generalized naming*, or the most general sort of Many words. —— Consequently, when we talk intelligibly we by some means indicate that the *THIS* is compared (which is to say:- related) to a *THAT*. That means or method of talking intelligibly may be by gestures, by interjections or sounds such as are made by the "lower" animals, by implication of some sort, or by explicit words. The means must truistically be explicit words when we propose to express something by means of language and with rigor.

e. We have seen that the Many words in the mathematical variety of speech have that comparison or relationship (with each other—which we saw in the last paragraph was needed in a sentence) expressed by means of symbols such as +, ×, = (§30e). We have seen that in a completely expressed sentence Many words are mutually related, giving a combined or One meaning that is the sentence (§32a). That statement of what we have observed is simply a detailed description of a complete sentence. And we may *roughly* express that typical sentence in mathematical symbols, thus:- *THAT*×*THIS*=*MEANING*. Obviously, that "equation" or mathematical sentence is the same in form as 2+3=5. I have used the × sign instead of the + sign, because it happens that later on ordinary science usually uses it; × is simply a sort of abbreviation for a number of +'s. All relationships are ultimately identical (§28h); hence, formally or logically it makes no difference whether we use a × or a +, if we consistently keep to the one started with.

f. That equation *THAT*×*THIS*=*MEANING* is only roughly expressed. I. e., it—and its equivalent sentence in ordinary words—contains numbers of implications which are not yet made explicit. We are now ready to begin making those implications explicit—writing them all explicitly into that as yet considerably abbreviated equation.

g. It may be stated here, in anticipation (and the reader can not understand it fully at this stage), that the omitted implications are in general two:- (1) the *THAT* obviously implies a series of other things, and so does the *THIS*; and hence—with all the explicitness we usually need, but not with complete explicitness—we can write them *THAT*... and *THIS*...; (2) and the *complete* implications of those things obviously are that they are *explicitly named*—or *measured*, as it is called by "science"—by the conventional or Euclidian *time* and *space*. Hence if we write only *THAT*...× *THIS*..., thus omitting that complete explicitness, we *may* include such explicit time and space in another, or *measuring*, member of the equation; obviously, that additional member is directly a *repetition in different words*, or *a truism*, of the first member. Hence, we have the general equation:- *THAT*...×*THIS*...=*A whole One*[*or a standard One*]*measured by the conventional time and space*=*MEANING*, or =*Energy* (as *Energy* is the "scientific" One, corresponding to our "logical" or verbal One:- *MEANING*). That equation (which is logically equivalent to 2+3=5, but more explicit) is the sum total of the argument of this book. All that a unification of knowledge is, is such a formal expression of a *complete* sentence. It is obvious that we may then substitute in it *any* terms, and have a complete statement of the meaning of those terms; or, the "solution" of any problem is merely the translation of such a complete statement into the terms naming the point of view (the time and space) of that problem. The further details of that complete statement or equation consist in noting just how we customarily use time and space to measure or name things, or concretely to replace the *THAT* and *THIS*. —— We drop that general anticipation now, and go back and observe step by step.

§34. a. In the equation *THAT*×*THIS*=*MEANING* it may be easily observed that the real meaning—which is whatever we have *observed* and *understood* when we compare 'this' and 'that'—is obviously *not* given by the word or symbol *MEANING*: it is given *explicitly* or *positively* by the *THIS and THAT*, and that observed meaning is simply *named MEANING* (and that name is set down in what is obviously a *tautological* or repetitional manner, for the Many names of 'that' and 'this' already gave that meaning once). Or, it can be directly observed that *MEANING* does *not* of itself positively mean anything at all. I. e., the last member of the equation, *of itself* has no meaning, any more than *Oh* has, or is *not* explicit, or is not *actual* or *positive language*: for it *itself* is *not* verbally separated into parts that can be *observably* or *verifiably* compared—and only the naming of such parts *in conjunction* can give a *verbal expression* of a meaning. —— The fact that a One word does not of itself positively express an idea is a fact not usually noticed, so thoroughly have we get into the habit of speaking nearly automatically. (The One is, *directly* considered, absolutely ineffable—§56, etc.) The One word merely names and thus formally or logically but not really *repeats* the idea positively expressed by the Many words (as joined together by the relationship words—by × in our equation). In short, we in practice say everything twice—expressing it by Many words, and then tautologically echoing it by a One name. It is a curious fact—when first noticed. So accustomed are we to that deliberate saying of everything twice (once "scientifically," and then again "religiously" or "ineffably" or mystically) that it is a bit difficult to describe it intelligibly. If the reader is still puzzled, in spite of my having stated the proposition in several different ways in the first of this paragraph, he may note that if we use language that is largely composed of One words it is called mysticism—and mysticism is of itself unintelligible (§20d).

b. As the substance of the last paragraph may still seem odd, I shall expand it in more detail:- If *THIS* and *THAT* be considered *positive* or *explicit* language (and, in agreement with custom we do so consider it—it being the opposite of mysticism), then *MEANING* is *not* language in any positive sense—but simply a convenient ejaculation, which is a sort of signal that we have "caught" the meaning already given. (It is like the last member of many formal equations:- "=0." Zero is a One word, and means nothing explicitly.) —— As we see under ethics (§162), *MEANING* is the milder, verbal or enunciated equivalent to the laugh which is given when we 'more energetically' catch the vivid—i. e., very clear—meaning of something. And a laugh is commonly agreed to be not explicitly language. A laugh, and the less energetic ejaculation *MEANING*, may be intelligibly conceived as a finished or whole or One nervous reaction (including emotions *and* intellect or meaning), or summing-up echo to something already expressed. Hence, it is glaringly a truism, that to accuse a person of having "no sense of humor" is substantially to accuse him of being so stupid that he can not sum up meanings as wholes or as a One. It is the same in principle as telling him he has not enough intelligence to make a sentence; and naturally he does not relish the criticism, although it is a fact that all of us have a limit beyond which we can not readily (and hence with a laugh, indicating reserve strength) sum things into a One—we all have a practical limit to our sense of humor (§149). Statesmen are supposed to be grave and solemn because they are handling matters weighty to the limit of human endurance

—a variety of poppycock (XIX) not indulged in by Lincoln.

c. We have seen repeatedly that our typical sentence, now in the rough form *That*×*This*=*Meaning*, contains a contradiction between the One and the Many which has hitherto in history been considered an actual self-contradiction. We see now with ultimate obviousness that the contradiction is merely logical or formal:- for we have seen that the meaning is not really given by *Meaning* [34c] —that being a mere ejaculation (and itself a meaningless word—by either the classic logic or the valid logic). Also, it is obvious that that formal "contradiction," improperly called a real one by the classic logic, *must* inhere, or *must* appear, in *any* equation, or in any conclusion or sentence, which sums into a One the Many that is detailed in positive words. Truistically, *if* we do not use words or symbols, that '*must*' does not apply: there is no such thing as what is conventionally meant by "logical necessity." That '*must*' is simply the brief way of indicating the implied truism that '*if* we use language, we *use* language'—of indicating that we will stick to our agreement that *if* $A=A$, then we '*must*' not say that simultaneously *A is not*=*A* (§22). See §35 for further consideration of "logical necessity."

d. This section shows rigorously in perhaps the most obvious way that there is no real contradiction between the One and the Many. It will be shown in other ways as we need them (Index, "One and Many").

§35. a. The complete meaning of *valid "proof,"* and implicitly of *valid "logic,"* and of a rational or actual *"logical necessity"* is given in this section. That meaning is needed to enable us to make further steps in expressing our general equation explicitly.

b. *If* we say or assert the formal truism $A=A$, *then* (if we honestly and intelligently adhere to that '*if*' clause) we '*must*' not say that at the same time *A is not*=*A*, *unless* we *agree* to change from that original $A=A$ form of speaking with which we started. We *can* make that change in agreement if we like, and explicity say that we now agree that *A*=*something that we shall* NO LONGER *name A*.

c. It appears generally from the last paragraph—and I proceed to show it in further detail,—that to reduce anything to such truisms is the *only valid* "proof" which can be *expressed in language*. Such a meaning of valid "proof" applies *only* to verbal *expression* of what we observe; and "logical necessity" is merely the '*must*' which we follow *if* we wish to be *verbally* honest and moderately intelligent. (It is a historical fact that "logical necessity" was not in the least considered a necessity, or even a requirement of good breeding or moderate intelligence, by some people who considered themselves quite logical; e. g., the well known remark about a "scrap of paper.") All the 'valid proof' which I can *print* or *express* here in this book is that verbal proof:- reducing or reduction to truisms. All real or absolute proof is actual *observation* or *experience* or experiment—seeing for ourselves. I can not see for the reader; hence, he has to get all the *actual* proof for himself, and make his own discoveries. If there is *for him* any discovery in this book, *he* makes it—not I. Hence, *logic*, which is the formal technique or trick of *consistent* expression, *can not give any real proof.* Logic gives *expressional* proof only, and such proof is reduction of expression to truisms.

d. It is not usually recognized that the only valid expression of proof is to reduce the expression to truisms. Classical logic substantially says that proof is something else —a step by step process from premise to premise. I. e., classic logic says (in its syllogism) that something to this effect constitutes the process:- *A*=*Something*=*Something else* =*Something else still.* That logic then considers that the last step is inferred from the premises (let us assume that the inferring it done in accordance with that logic's rules), and that hence the last step is "proved." As a matter of glaringly obvious fact, it is not in the least proved, even in explicit expression; the actual proof (when that step happens to be true) is obtained by the reader for himself by observing whatever it is the expression vaguely implicitly points to, and the classic logic does not give even an explicit *expression* of proof, as that requires statement of truisms. (On the contrary, classic logic asserts that such expression of truisms is *circular* reasoning, and that such reasoning is invalid; see par. f.) Ignoring that parenthesis here, we see that classic logic thus begs the whole question, wholly omitting actual consideration of "What *is* the *expression* of proof?", which is the relevant question. The classic logic in all that, tacitly concerns itself with a much different question:- "Does the universe exist?" But as soon as we begin to talk we *verbally* assume the existence of something about which we are talking—as was seen in §22, where we saw the rigorous formal proof that there *was* something. The actual *saying* of all which can be said, *and then* the *observing* that it does apply to that 'something' is the real proof of the issue which classic logic always irrelevantly raises. By declining to be thus irrelevant ourselves, we see that *logical* proof (i. e., expression of proof) is the expressing of a truism. Obviously, if we show that *A* is a number of things, and then fail to assert that those things *are A*, there is *no* explicitly completed expression of proof—no *logical* proof. —— It sounds silly, doesn't it? That is because it is so excessively simple. And because it was so simple, classical logic substituted an irrelevant question for it (thus fundamentally contradicting itself as to what it was about—see Dewey's Introduction for an explicit technical and historical statement of it), and the result was agnosticism, and finally the recent war. If we can dodge another such war by becoming intelligent enough to start with things that are so simple and easy as to seem silly, then such things are important.

e. If the point of the too-obvious remarks in the last paragraph is not yet quite clear, let us take a concrete illustration:- Suppose that a man thought his name was *Smith*. How would he go about validly *expressing* the proof of what happened to be the fact that his name *was Smith?* —— Thus:- He asserts to begin with:- "If all men having cognizance of me agree that I am named *Smith*, then *Smith* is my name." Then he produces a number of persons, all of whom say:- "His name is *Smith*." Therefore, Q. E. D., his name is *Smith*. Obviously, it is all a truism:- *if* he is named *Smith*, *then* his name is *Smith*: he *is* named *Smith* by those who do name him, therefore he is named *Smith*. —— Now, the classic logic becomes irrelevant right at the start; it asks *What is his name?*, and then promptly goes off on a

[34c] I have abandoned the printing of *That* and *This* and *Meaning* in capitals. I find that all-capitals is too glaringly conspicuous on the printed page; the reader does not need so much emphasis on the fact that he is dealing with a symbol—that all words are symbols. Also, all-capitals uses up too much space. —— I could of course reprint the last two pages, and conceal my bad judgment or taste in starting with capitals—which, although they look well and are needed on the written and typewritten page, are out of place on the printed page. I have little patience with amateurs who insist on blundering publicly. But I *am* an amateur printer—or rather a printer perforce. Hence, it may be well not to try to conceal it. It is an excellent thing, I think, to give the reader a concrete example of the fact that I am not infallible—that he must verify my doings and sayings for himself. Also, my leaving the pages as printed shows that my mind it still flexible enough to conform to changed circumstances. Also, the undue typographical emphasis of the two pages may be of advantage to readers. Also, it would cost me two days of work and $2 for paper, to reprint them.

tangent trying to discover what a name *is*, anyway. The problem of What is a name? is a different problem, which requires observational proof: it involves the existence assumption (§22), and can be "solved" only by giving a complete unified *description* of the universe and having the reader verify it for himself. (And similar remarks apply to the analogous *directly* irrelevant questions of number and credibility of the witnesses, of the judges, etc.)

f. Hence all *logical* proof of a verbal statement consists in reducing that statement to an obvious truism. As we saw with respect to our equation (§§34a, 33g), we begin with actual tautology in language: I am now showing that we end with such tautology. Consequently, as a truism of the ordinary definition of "circular reasoning," all valid logic is circular reasoning (see the proof of Smith's name). That looks heretical, but we may readily see that it is not really so:- (We have to anticipate conclusions rigorously derived later on; for final summing up of proof that valid logic is circular, see §58j.) If we "reason" from the One—i. e., analyze it into the Many,—we derive the Many; and to "prove" the reasoning we synthesize that Many back into the One. And that is circular reasoning. Obviously, as we can not get out of the universe, we have to reason 'around' in it: that is a truism. —— Usually, we reason in standard universes. In such cases our conclusions neglect the remainder of the real universe; and because they do, *always* in such cases they are *quantitatively* inaccurate. Classical logic observes that truistic fact about our customary standard universes; and the *practical* trouble with that orthodox logic is that it then promptly jumps to the erroneous whole One, or qualitative, conclusion that *all* circular reasoning is wrong, whereas the fact is merely that standard Ones are *quantitatively inaccurate*. But the circular reasoning in standard universes is qualitatively or in principle, or essentially, correct; and *all* reasoning or consistent expression is, so far as *total explicitness* is concerned, *quantitatively inaccurate*.

g. This section, which anticipates somewhat, has served to introduce the following facts, the detailed proof of which can be observed as we proceed:- We have explicitly begun with a tautology or truism:- *That*×*This*=*Meaning*. So we must end by showing that it is a truism, or is tautological. Hence, whenever our *expression* or language departs from being an *explicit* truism—departs from saying *Meaning*=*Meaning*, to saying *That*×*This*=*Meaning*,—we truistically must have a formal contradiction. That 'One and Many' contradiction is hence essentially inherent in any *positive* language. Therefore, the whole of a valid logic (just the logic formally considered of itself, and not considering its *use* in expressing knowledge) is to show or make obvious the existence of such a formal contradiction, in summing any set of details into a whole or One conclusion. Only the existence of such a formal contradiction allows reduction to a truism; and such reduction is the only proof in a logical sense.

§36. a. When we say *This* and *That*, we have implied that we *move* or *travel* from one to another in some way—even if only "in thought" (for more precise statement of "motion," see §97). That 'travel' definitely brings in the ideas of *space* and *time*—which are at least implied *whenever* a Many word is used, and *never* when a One word is used. As we shall see, *space* and *time*, in their fundamental usage are relationship words. For, when we split the One into the Many for verbal purposes (that Many being an inherent neccessity in making a positive language—§35g), we use space and time as a verbal *form* by which we consider it logically done, or name its doing; then, when we want to *understand* (*re*-collect) what we have done, we use (express) that space and time as a relationship ('travel,' I arbitrarily called it above), to get the parts verbally together again into an intelligible One. A *separated* Many is not intelligible—chaos is its conventional name. Most scientists say that a separated Many, or "action at a distance," is inconceivable.

b. In that last paragraph we have a complete summary of the ultimate character and use of *time* and *space*. It probably is too condensed to be obviously true; so we shall have various details as they arise (§§57, 59-62, 64, 66, 97, 150, 161, 165, etc.; also, Index, s. v. "Light, velocity of"). There are a number of words that practically mean time and space. But usually all the scientists and philosophers and theologians agree to condense the verbal puzzles of them into the two words *time* and *space*. The reader can probably see from the last paragraph that those puzzles evaporate very simply by noting the obvious. It took me five or six years of steady work to learn to write that last paragraph: so it may take the reader five or six minutes to grasp it. The difficulty with the paragraph is that it is *too* obvious. It is so obvious that Herbert Spencer wrote a system of philosophy or science and substantially forgot to consider time and space: it (or they) bobbed up however in the guise of his "Unknown"—and a considerable addition to the world's load of deadening agnosticism resulted.

c. We shall consider that travel between *This* and *That*. If *That* be my pencil, and *This* an egg possessed by you[35c], if you want to *understand* (*really* prove) a statement about the two (get its meaning), you have to go from one to the other and see for yourself; ultimately, you could not take my word for it, and if you had not before experienced (observed) a pencil, you would have no idea what unit of the Many that word *pencil* pointed out, even though you wanted to take my word for it. (I might verbally 'construct' a pencil—describe it intelligibly—in terms of other units of the Many previously observed, or now readily observable, by you; but the ultimate proof or understanding of my expression is that you see for yourself; you may be ocularly blind, but you still have to use me as a more or less remote tool, and use your own senses and brain for the direct "seeing.") That obvious fact, that in some way you have to go from one thing to the other and look at them—"experiment" with them,—explicitly introduces space and time, both being thus at least *implied* when we speak of *That* and *This*.

d. Hence, if we become *more explicit* in our language, we must definitely name the *space* (which we may abbreviate to *L*, for "length") and *time* (or *T*), when we name *This* and *That*. We go from *This* to *That*, passing over a space *L*; therefore we shall definitely say so, thus:- (*That*×*This*)*L*. (The parenthesis marks, ( ), as thus used in mathematics are equivalent to a ×—are merely a different way of symbolizing a relationship.) But we require time *T* to pass over that space: the more space we pass over the directly proportionally less time we need to pass over *all* the intervening space before observing and expressing the final One or *Meaning*. So we definitely say that also, thus:- (*That*×*This*)*L*/*T*. But when we get to *That* we are traveling only on a geometrical line—on the line or one dimension represented by *L* or length (and *completely* represented by *L*/*T*). To see *all* of *That* we have to travel out into the other two

[35c] I trust that I may be forgiven for addressing the reader directly in the second person in this somewhat formal book. At this point the number of facts we must attend to is so large that it helps considerably in achieving rhetorical clearness to use the readily distinguishable and readable second person pronouns. The reader may perhaps consider that the saving of his effort in reading is sufficient warrant for the use of that rhetorical device. —— I noted that in occasional places further along in the book it became rather absurdly stilted to revert to 'the reader,' and I did not do so.

dimensions (if my pencil were several miles long you could not see it all from the line L; even with an ordinary pencil you do not confine your vision to one geometrical line L). So we put in that fact explicitly also (although we still shall not have a completely explicit statement), and have $(That \times This)L^3/T^3$.

e. A logical or expressed proof that there are *three* dimensions is required. It is given in §59. We usually say that we observe directly that there are three dimensions. We do not *directly* observe that: directly we observe that all things are joined together, and from different points of view we give various names to that one identical relationship, one name being *space* (see §150 for the simultaneous inclusion of a cancelling *time*). We can observe directly, from the last two paragraphs, that in order to get a *That* and *This* from, or out of, a connected universe, we tacitly put in what we called *space* to "distinguish" them apart, or *arbitrarily* separate them, or make them have a "Difference." Then, when we came to talk explicitly about *That* and *This* we promptly used that same space as a *verbal link* to *connect* them. Obviously, we thus really used space in two *directly opposite* ways, and thus absolutely cancelled it out, as being a mere form to begin with. You may thus see in detail (see also par. j), from this present point of view, the truth or consistency of the general summary of the nature of space in par. a. There are other points of view which we see from time to time—altogether an infinite number of points of view, all of which show that space and time is-are formal and cancels out, are possible.

f. But that much explicit expression—$(That \times This)L^3/T^3 = Meaning$—does not give us the whole explicit expression:- for the *This* may have *changed while* we were going to the *That*. *This* was (as an example) your egg; and it might have hatched and the chicken might then have walked off and got lost while we were going over L to *That*. And in that case our expression $(That \times This)L^3/T^3$ about the two things would not be quite exact or true, because there was not the explicit *This* egg with which we began, but now a lost chicken *This*. You may readily observe a baby lose his 'egg' thus in counting (in mathematical naming or talking); he then does just what we are going to do—goes back and finds it, or "verifies" it again,—only we are going to be very explicit and formal in *expressing* what we see and do. This learning the truth of all things—which from our point of view in Part One is the verbal trick of expression, or the logical or mathematical or philosophical game—is nothing more than being a little child with a good memory. The words I am writing here are nothing more than an aid to your memory—they help you concentrate on, or collect together, what you already know. Being myself too sophisticated about counting, I got that aid for my memory by watching a child count—as was mentioned.

g. So we have to go back to the egg *This*, to see it again and be *sure* that our expression $That \times This$ is verbally or formally positively correct and accurate before we "release" that expression for publication, and then become chagrined to find that *This* is a lost chicken instead of the asserted egg. So we *go* back to the *This*. But my pencil *That* might have had something appreciable happen to it while we were going to the egg. So we go back to *That*, and verify it. And in the same way we *obviously must* do that ad infinitum, or in *infinite regress*, *if* our language is to be *perfectly* explicit or positive, or is to be accurate. (In this book, when I say *accurate* or *exact* or *perfect*, I mean absolutely accurate or exact or perfect—which is merely the conventional meaning. When I mean fairly or roughly accurate or exact I say *definite*, or something that more explicitly indicates an approximation.) —— We *must* make that infinite regress *if* our language is to assert exactly the details which do exist when we speak, and which details are observable by us if we proceed to see them *all*. We have proposed, as does conventional science and mathematics, to make a *completely explicit* statement, and it is simple honesty, or intelligent adherence to our agreement to keep on saying $A=A$, that we do make that *explicit* statement or else proceed to state just where we fall short of such exactness. Therefore, we write that *infinite regress* directly, thus:- $(That \times This)L^\infty/T^\infty = Meaning$. —— That equation does not yet express *explicitly* the fact which we observed, that *This* and *That* changed: the L^∞/T^∞ indirectly asserts it of course, but asserts directly and *explicitly only* the ad infinitum travel. I put in that omitted explicitness in par. l.

h. And in deriving that equation we tacitly assumed that *This* was some part of the universe, just as when we say '2' we actually mean '2 things.' Just "2," the absolutely abstract "number" 2, without any implication, is utterly meaningless. The most "abstract" way in which we can conceive "2" just alone, and not have it utterly meaningless, is to consider it a relationship word implying that it means, or is the *verbal link*, joining one thing and another thing into a whole; in such a case any "number" is correctly and validly equal to any other "number," as they are then all simply equal to links, or relationships, and the *only* relationship is identity (that way, in which any number is equal to any other number, is explicitly proved by orthodox algebra in §44; it is also one view of "number" taken by Einstein's relativity, §66). —— In orthodox science or in a formal equation the *This* and *That* are often given by just the "abstract" number (as by "2"), and then the '*things*' that also belongs in the expression is frequently *forgotten*—with disastrous consequences to the logic, resulting in a final agnosticism (also in the orthodox mathematical nonsense typically shown in §44). Consequently, we are safer if we put the term '*things*' into our equation, in some form, so that in the equation there will be an explicit assertion that we are talking about 'parts'—about actualities, and not about mere words or symbols. The customary scientific symbol for 'thing,' when such a symbol is explicitly asserted, is M, the initial of *mass*—a thing, or in general a part of the universe. So we may stick that M into the equation, without meaning that some new "number" is multiplied into *That* and *This*, but that they *explicitly* mean the Many. The M we put in is to be a *unit* of mass—to be a standard,—which thus merely names the sort of measurement, and hence will *positively* provide for the equation's being used as a standard universe *if* we so wish. So, in an algebraic sense, the M *is* multiplied; but so long as *That* and *This* are also explicitly *retained* in the equation, M is unity—or, is simply 'thing': *one* thing. The fact obviously is, that when we have a *completely* explicit equation (i. e., when the space and time are really taken as infinite), *That and This* become the total universe, and in that case M is the unit which *is* the universe (as we shall see further in par. l).

i. An additional fact about the M is that we are forced to be explicit as to a unit of measurement, if we are to observe our agreement $A=A$. Orthodox science sometimes is not, and gets into fearful logical confusions (cf. theory of relativity, §66). For, if *That* and *This* are, as we took it, a pencil and an egg, we can not intelligibly multiply *them* together. $Cows \times horses$ is nonsense. The M explicitly asserts that a common unit of measurement is taken and applied (ultimately it means that the egg and pencil are *joined* and then measured simply as occupying space, as we shall see). Hence, the explicit presence of the M keeps us from

starting talking such nonsense as *Pencil×Egg*, by asserting that a common measure (finally it is *L* and *T*) is applied to those names. Therefore, we have the more explicit equation:- $(That \times This)ML^{\infty}/T^{\infty}=Meaning$.

j. Also, we truistically conclude—as another aspect of the arbitrariness and unreality of space and time,—from our way of naming *L* and *T*, that whatever they are, or however we name them, they vary directly proportionally: in fact, that is what I said when they were explicitly introduced into the equation (4th sentence, par. d), and the statement was made to agree with obvious facts which we can verify at any time by watching a baby count (for explicit statement of it from the point of view of *T*, see §§150-1). Hence, *L* and *T*, so far as *either* the meaning of our Many expression, *or* of *Meaning*, is concerned, actually cancel each other. I. e., space and time, so far as this language we are constructing is concerned, is-are absolutely arbitrary. They are mere verbal counters. We saw directly in par. e that space was unreal and simply a verbal form. Obviously, in precisely the same way as there used for space, we can see that time is unreal—it is implicitly done in §150. And in this paragraph we see further, and as a *formally* separate observation, that when we consider time and space together, they themselves formally cancel or contradict the reality of each other. —— In short, our language machine is a very close-knit affair. In whatever way we regard it, we may see at once that there is always the formal contradiction (here we observe it between *L* and *T*), but that always the very description of the language structure truistically declares the contradiction to be unreal because it at once cancels. These somewhat minute examinations of the language machine—e. g., the one in this paragraph—need not be remembered. They are exceedingly tiresome if you try to remember them; I never remember them, but work them out by direct observation when I need them. But if there is any point of the extensive, important conclusions we are shortly to reach which you wish to see for yourself in ultimate detail, then these minute details are here to refer to.

k. Perhaps some readers have formerly been puzzled by the idea that time and space are "real" in the sense of concrete or objective (although leading scientists objected to the idea on the ground that *L* and *T* could not be manipulated in a test tube as could H_2O); or by the dualists' messes of time and space, and by views as to "transcending" them, apparently in our Many personality; or by the mathematicians' *n*-fold space which they themselves blandly admit is sensibly inconceivable (§62). For those readers, as a general means of clearing up those puzzles, I add this paragraph of direct observations as to the nature of space and time. (From time to time additional concrete details, more easily seen than this paragraph, are added.) —— It is clear that we have above used space and time, or *L* and *T*, simply as verbal copulas. They are a paired name (i. e., L/T) for God the Holy Ghost, which we *implicitly* introduce when we first consider *This* and *That* as separate (introducing it in order to make them separate), and then have to put in a second time (cancelling the original contradiction) in order to get *This* and *That* back together again into the One. Hence, L/T is simply tautological with the ×. Therefore, in the expression $(That \times This)L/T$, the contradictions '×' and 'L/T' mutually cancel—which is another way of showing how close-knit is our language machine. —— Perhaps the simplest way of seeing the nature of time and space is to try for yourself to see which of the three kinds of words (as in the Trinity) they correspond with when used in the senses above. Of course, *space* is sometimes used as meaning that which is a part of the universe and really meaning the matter that fills it, as a *cubic foot*—which insofar as it is a Many term obviously indicates the human foot. And sometimes it is used to mean the total universe, as *all space*; then it is obviously a One word. And *time* may similarly be used as each of the three sorts of words; but it is not so usual for *time* to be anything but a relationship word.

l. If we had actually done all that traveling which was or is necessary in order to get the absolutely accurate (although not yet *fully* explicit) statement, $(That \times This)ML^{\infty}/T^{\infty}=Meaning$, we obviously would have traveled, naming or counting, *all over* the universe. And obviously, the *That* AND *This* would then have finally coincided as being absolutely identical with the universe, or as forming the universe (see last sentence, par. h). Hence we can drop the verbal counters *This* and *That* if we like (as they have merged into identity; also because it is often customary in everyday language to do so; and also because we shall still have in the *M* an explicit name for concrete things), and we have left the ML^{∞}/T^{∞}, which is still the universe, or a One or meaning. Or, we have *M* [meaning the whole universe] $=Meaning=Universe$,—which is obviously the truism *The One=The One*. And we have noted or observed only one *fact* in the whole process of writing an explicit and accurate sentence or equation—the other observations were merely of word *forms* or agreements: were *arbitrary inventions*. That *fact* is that the *This* (which merged with the *That* and hence implied it: and also implied the *M* and is the *M* if we drop explicit mention of *This*), *varied* in some way while we were engaged in traveling over *L* in *T*. (The concrete fact was that the egg hatched, or at least changed in *some* way. The object of cold storage is to prevent as much as possible eggs' changing—and it is well known that even there they still do change. Part Two shows in detail that all things always are changing.) —— Also, the fact that there *was* change is truistically *expressed* by the verbal logic or form:- that the *That and This* changed so as absolutely to merge into each other and hence become identical with the universe (mutually inclusive). But that truism has not been fully verbally expressed in our equation—especially it has not been definitely asserted that *M*, which explicitly names *This*, does thus vary. Therefore, we will explicitly say what we observed, thus:- $M(varying\ with)L^{\infty}/T^{\infty}=Meaning,\ or\ Universe$. That equation is then simply our truism, *The One=The One*. But the truism, in that explicit *M* form, asserts that the parts of the universe move or change in some way. And that motion or change is nothing more than a verbal or formal agreement (so far as *expression* is concerned) with our formal assumption that we '*go*' from *This* to *That* (or, finally, so far as expression is concerned, *motion* or "energy" or "life" is nothing more than that the universe is formally divided—'changed'—into parts, or into *This* and *That*; cf. §§50, 97). —— Therefore, in *expression*, we have simply a more explicit truism. And if we take it as an observable or existing fact that the parts change, then we accept *motion* as a fact, as change is motion. But, as we shall see (especially in §97), we do not need to assert that "motion" is a fact, or 'exists.' We can assert "absolute rest" or "eternally static" (some people do do so); and we would finally get the same meaning. So it is immaterial whether we say 'rest' or 'motion.' "Motion" is more conventional, so I take that word.

m. We now have an expression, $(That \times This)M(varying\ with)L^{\infty}/T^{\infty}=Meaning$, which is completely explicit and accurate—logically or verbally. (We as finite individuals can not of course *practically use* any such expression; we come to that point in §38.) When we say 'John is a boy,' we imply that complete equation. —— And we have noted possible variations in the method of writing the first member of that

equation, depending on the *degree* of explicitness we wish to achieve, as follows:- *That*×*This*; (*That*×*This*)L/T; (*That*×*This*)L^{∞}/T^{∞}; (*That*×*This*)ML^{∞}/T^{∞}; *M*(*varying with*)L^{∞}/T^{∞}; and *M* [meaning a whole One]. In the next section we begin to note important conclusions and applications. Here, we shall obtain one more variation in the method of writing it that is of considerable use.

n. We have seen that in order to write *That* and *This* accurately, we are forced into an infinite regress of comparing them more and more carefully, because they change. The changing was a mere truism of introducing space and time at the beginning as a means of getting *This* and *That*. Above, I have explicitly *expressed* that regress by L^{∞}/T^{∞}. There is another more conventional way of expressing it which we shall find more useful:- We may write it *That*... ×*This*...; or, we may express the same thing with a single word or symbol, as *That*..., or *M*..., or *This*.... The dots ... are the usual typographical sign indicating a continuing series, or regress, or verbal step-by-step process, when explicit naming of *all* the members of the series is not gone through with. Or, the dots ... mean simply "etc.," or mean that the completion of our ad infinitum process is omitted. (In English the dots typographically spread out, thus:- . . .; but for obvious reasons it is preferable to use the compact French fashion in this book.) —— We may conceive the meaning of the dots in a much simpler (i. e., more familiar) way than to consider that they replace the M^{∞}/T^{∞}:- When we say *This* we *imply* that there are other *This's* and *That's*. Hence, we may say that the dots ... mean that in order to state *This completely* or *accurately* we have to go on and name an infinity of *This's* in comparison. Therefore, *explicit typographical* expression of *any This*—of *any* part of the universe, or of any unit of the Many—is *This*....

§37. a. By explicitly formally expressing *any* statement, using general words or symbols to do it, we have derived an equation or sentence which we can put into various forms, depending on how explicit we wish to be. And we have seen that each form reduces to an explicit truism. Thus, the general explicit form was *M*(*varying with*)L^{∞}/T^{∞}=*Meaning*, or *Universe*: we may write that, *M*...=*Universe*, and obviously (as a truism of our agreement as to what symbols mean) *M*... is the universe, and we have *Universe*=*Universe*.

b. But clearly such explicit truisms are not useful in ordinary speech. Also, in ordinary language we can not *actually* express that infinite regress which is implied whenever we use a Many word. Therefore, we need (1) to get those various forms into directly useful shape, and (2) then to note, and express very carefully in conventional terms, just what our practical typical equations or sentences mean. Actually, we are going to see that all the general laws of science, philosophy, and religion are definitely implied—even expressed—in those type sentences. It will take the whole book to show that. But it is obvious that if truth is consistent or unified, then it is a truism that all of it may be reduced to explicit expression by one typical sentence.

c. The form which is usually implicitly used in everyday speech is *That*...×*This*...=*Meaning*. That equation simply explicitly asserts a comparison of things—a verification. And it is obvious that when we talk we compare things—describe the less well known in terms of mutually familiar things. Or, all language is metaphor or simile. It is better to know explicitly that trick of talking. Then we are less liable to depart from it, and try to talk of things as being absolutely separate (which of course implies that they are absolutely without comparison); such talk is nonsensical.

d. As immediate rough evidence of the fact that that everyday equation "explains" things, or "solves" problems, or gives intelligible talk, we may in the remainder of this section observe some examples of its use. (These samples are here quite roughly stated: the more definite statements —which would not be very intelligible at this point—are in the last chapters.) —— Our Constitution makes a broad comparison of (1) *That* and (2) *This* by the method or terms of comparing or joining (1) the various state governments and (2) the federal government. The (1) state governments may run into as many explicit dots (*State Governments...*) as we can write, by naming governors, legislators, etc., on to the individual citizens—and on to the parts of their component atoms. And (2) *Federal Government...* may have as many dots as we care to name, such as president, congressmen, messenger boys, on to the details 'federal citizens,' and on to pins owned by them, etc. The Constitution broadly makes the *Federal Government...* react as a verbal Many, or as a part of a machine, with *State Governments...*, thus:- *State Governments...*×*Federal Government...*=*Country*, or *Nation*. That is a standard universe (unless we consider it in the light of §47, which we need not, here). —— But we can divide our *Nation* into reacting pairs in an indefinite number of ways by making a division in those infinite details or dots from other points of view. Thus, we have *People...*× *Officials...* (a form of equation which is recognized or indicated by the first ten amendments to the Constitution—the so-called bill of rights). Or, we may have *Congress...*×*President...*. In that pair, the dots in *President...* obviously will finally include the people who elect a particular man as president (which means, for one thing, in ordinary language, that the people are perceptibly a part of the president as such, in that they can have him impeached, etc.). But *Congress...* also includes with more or less definiteness the same people. So there is an obvious example of *That...* and *This...* becoming identical when carried out a little in detail. —— The Constitution explicitly asserts a democracy—a reacting, or interacting, or *formally* and explicitly (as well as actually) related *That...*×*This...*, or machine. And the Constitution in effect states that regardless of how the standard One or *Country* be considered as thus arbitrarily or 'logically' divided into parts, they are *compared*, or *balanced*, or are of *equal logical* or *formal* importance, but explicitly are not of equal *quantitative* importance or "value."

e. But in an *attempted* aristocracy or autocracy (there can not possibly be a real or actual one; §174) an attempt is made to depart from the valid equation *That...*×*This...*=*Meaning*. The people in an aristocracy are mostly called subjects or vassals, meaning that they are expected to be essentially or in principle subordinate, and *not* a complementary or reacting part of the whole. In short, with respect to the government (to the autocratic officials) the people are said to be officially or logically nothing or zero, so that we have the attempted equation *Officials*=*Nation*, or *One*. I. e., it is in *verbal* effect denied that there *is* any reacting part, or other unit of the Many such as *That...*; and it is also denied that there can be any dots, which can, by a division from a different point of view, give reacting or comparable parts. Obviously that aristocratic or dualistic point of view is arrant nonsense. As soon as we see how we *must* talk about the Many *if* we are to talk at all in positive or concrete terms, we see that there *must* be reacting parts, or a machine. When the autocrat says that *he* is the state, he asserts:- *An individual of the Many*=*The One*—which is obviously equivalent to the claim of divine right, or ex officio infallibility, because in conventional terms the One is God. Such logical absurdity is admired and praised by some; by others it is variously named autocracy, aristocracy, egotism, paranoia, megalomania, hysteria, or excessive selfishness. —— All

of that states a logical or *qualitative* proposition. I have made no assertion or implication that one part of the essential machine is *quantitatively equal* to another part. As a fact, no two parts can ever be quantitatively equal during a finite time (§§162i, 164, 167-8). The *quantitative sizes* of *That* and *This* become a matter for measurement, by means of L and T, and we are to investigate that matter; but clearly, that difference in size does not affect the principle that there must *explicitly* be at least two reacting parts.

f. Thus we see that *essentially* there are no "superiors" or "inferiors" among the parts of the One. On the other hand, *quantitatively*, or from the arbitrary L and T point of view, the parts of the One are always of different sizes. That double aspect of the application of our equation—(1) the essential or qualitative aspect is the One; (2) the quantitative aspect is the Many—runs through every act of our lives. Thus:- no "line" organization can, *as such*, possibly work, as it is self-contradictory nonsense (§§174c, 175, 167). A line organization is the so-called military one, wherein there are asserted to be essential superiors and inferiors (so that by virtue of rank an order is correct, etc.—just as the pope, in the Catholic line organization or ecclesiastic hierarchy, is nonsensically held officially infallible).

g. Those conclusions are anticipated here to show that what superficially seems to be a rather trivial investigation of words clears up everyday matters that confuse and puzzle many. Continually we are going to be using that form *That*...×*This*...=*Meaning*. And usually we find that merely to express a point of view in that form throws such an illuminating light that further explanation is rather needless. Also, as we all must be able to estimate the different quantitative sizes of men (XVIII, XIX), we further need to know about the measuring form of that equation—we need to know very definitely about L and T, and see how those apparently "abstract" relationships are applied to simple "material" parts of the universe—as a means of learning to apply that form to the complicated parts named men.

CHAPTER V. *General statement and proof of how to apply language.*

§38. a. We may write our explicit statement thus:- *That*...×*This*... = (*That*×*This*)ML^{∞}/T^{∞} = *M*(*varying with*)L^{∞}/T^{∞}=*Universe*, or *Energy*. In practice, an infinite regress or the L^{∞}/T^{∞} is not *positively* stateable. Consequently, in order to get rid of it *explicity*, we *assume* (this is an actual assumption, in that it is not an exact fact, and will *always* in *practice* make our equation *inaccurate quantitatively*; but in §42d we get rid of the assumption formally or logically or *qualitatively* by cancelling it out—doing that by the simple method of asserting the real truth:- that the equation *is* inexact)——we *assume* that *This* does not *change enough* to make any particular or important inaccuracy in the truth of what we say, *during* the time we go to *That*, if we do not return and re-view and re-state *This*. Or, we assume that we can guess at what change there will be in *This*, and hence state *what* the parts *This* and *That* are simultaneously, without going back to *This* to see that change—and thereby losing the *exact* change in *That*, and having to return, and so on ad infinitum. We therefore, (1) drop *explicit* stating of the dots before they become absolutely infinity (we as finite individuals have to discontinue naming them at some time); and (2) we also drop the infinite L's and T's that symbolically gave the impractical *positive* naming, and have:- *That*...×*This*... = (*That*×*This*)ML^3/T^3 = *M*(*varying with*)L^3/T^3=*Energy*. The dots ... of *That*..., etc., now mean *in practice* that we can not *positively* go on and name each one to infinity. They also, in practice, explicitly mean that they *replace* the ML^3/T^3 in the more explicit form, (*That*×*This*)ML^3/T^3; i. e., *That*...×*This*... is really an abbreviation which implies *always* that a definite measurement by L^3/T^3 must be made *if* we are *quite practically* explicit. Usually in this book I do not print that full form (*That*×*This*)ML^3/T^3. Hence, *always* hereafter, unless definitely stated or indicated otherwise (e. g., as in the cases where I am showing what pluralism or the classic logic verbally asserts), *That* and *This*, or any of the numerous analogous symbols or synonyms into which they are translated, are to be understood as having dots; i. e., logically every Many term *implies* the infinite regress (the classic logic *verbally* tries to deny that regress). For various reasons, on a few occasions I omit printing the dots.[38a]

b. And conventional science, for reasons of convenience (§§68d, 72-3), changes the L^3/T^3 into L^2/T^2. We may therefore drop out an L/T in the second member, remembering that it is implied (see §72), and we have what I shall call our general equation, or general sentence or statement:-

That...×*This*...=*M*(*varying with*)L^2T^{-2}=*Energy*.

c. That equation expresses, formally and in a fairly conventional scientific way, all knowledge. It is as conventional in form as it is validly possible to make it. Orthodox science usually (in the older textbooks) asserts the equation ML^2T^{-2}=*Energy*,[38c]—making totally illogical and somewhat inaccurate assumptions (§72, etc.). Our general equation closely resembles that orthodox one in form; and the fact is that our '(*varying with*)' is a number or "coefficient" that in ordinary circumstances *quantitatively* is equal to *approximately* 1 (§§72-3, etc.). But *in principle*, the orthodox equation asserts that the *part M* is isolated (has *no* dots); that there is no other body with which that explicitly named M reacts, but that it just has energy *of itself*, whatever that mystic statement may mean (of course, all commonsense people, and Newton's first law in effect, hold that there is energy displayed only when that named M reacts with some other body or M; I am merely showing what the orthodox equation really asserts, and how it is interpreted). In short, the orthodox equation asserts that *M*=*The One*—which we saw in §37ef is nonsense. Our '(*varying with*)' is ultimately merely an explicit assertion that there *are* dots—that the part is really *M*..., *implying* an indefinite regress of *other M*'s with which it reacts or really ultimately joins.

§39. a. We begin now to note the rather numerous

[38a] As we shall see, the above *practical* use of L^3/T^3 for L^{∞}/T^{∞} is merely *arbitrary*, and not essential. When we make that practical assumption, besides (A) making the statement or equation inaccurate, we also (B) have selected our ordinary everyday language as the language we shall speak. We did not have to select that particular language. We could (1) have selected L^n/T^n, and thus obviously got any one of the indefinite number of arbitrary languages of a "space" of other than 3 dimensions. Also, we could (2) have taken it that L was not Euclidian or "flat" space, and got any one of an indefinite number of languages—*which* one we got depending on the *quantitative* degree of "curvature" of the space which we arbitrarily selected. Or, we could (3) have assumed that L and T did *not* vary proportionally—were not mutually steady—and got any one of an indefinite number of languages known collectively as the "relativity theory"—which one, depending on the particular quantitative degree of disproportionate variation (of "jelly-fish" shaking of space described in §66) we selected for any given case or statement. We consider those different sorts of languages in VIII.

[38c] Usually science writes that equation $\frac{1}{2}mv^2$=*Energy*, where m is our M; and v is velocity, or L/T, so that $v^2=L^2T^{-2}$; and ½ is the numerical result of differentiating or averaging the change of velocity (on the erroneous assumption that there is not our '*varying with*'—as we shall see). ML^2T^{-2} is the so-called dimensional form of $\frac{1}{2}mv^2$, which drops such "abstract" numbers (§68).

conclusions that are directly observable in that general form of a complete sentence. It may first be observed that the reason for using the "mathematical" form is that we have noticed such a considerable number of implications contained in language that we see we need the formality of mathematics to make them explicit in a statement brief enough to be easily remembered—one that is an aid to memory rather than a burden. If we like, we can put that form which we mostly use into "words":- *'That and this is something.'* But even compared with that form, the "mathematical" way, *That...×This...=Meaning*, seems to be terser, and more illuminating to the eye. The equation is merely a mnemonic device—all equations are, and in a sense language is.

b. I may repeat somewhat, in summary:- The three members of the general equation are three different forms in which identically the same thing is asserted; i. e., the three are the truism $A=A=A$. The first member, *That...× This...*, expresses the Many in everyday terms, asserting that the Many is really the One. The second member, $M(varying\ with)L^2T^{-2}$, expresses the Many explicitly in measuring or quantitative terms (explicitly in terms of time and space)—again asserting that the Many is really connected continuously into the One. The third member, *Energy* (or *The One*, or *Universe*, or *Meaning*), expresses the One as a tautological echo, without being itself positive language.

c. We may now see that in so far as it is consistently possible to distinguish apart philosophy, science, and religion, the three members of the equation respectively do it. The *meaning* or *content* of philosophy, science, and religion is obviously identical (assuming that each *has* a valid meaning, as is the case if the names are honestly applied or if we stick to $A=A$, and if this book proves that knowledge is unified). Hence (unless the book fails to unify knowledge —to show that *The Many=The One*), no valid *essential* difference can exist between religion, science, and philosophy; they are an inseparable unit, mutually including each other, just as *That...* ultimately merges identically into *This...*. Hence, the *difference in form* (an arbitrary, L and T, or quantitative difference) implied by the general equation is the only valid distinction between the three.

d. The *That...×This...* member is substantially the form in which knowledge or experience has been discussed by philosophy for centuries. And the same form, which speaks of observations in customary terms such as "this" and "that," and compares such Many terms with each other, is obviously the form used by the average man, in which to express everyday matters. Practically all of humanics is expressed in that form: it is used throughout Part Three. Theoretically or technically, it is "philosophy"; practically, it is the brief commonsense way of expressing what we ordinarily see or think of. *Essentially*, the foregoing discussion of language (which some critics would nearly surely condemn by their curse-word "philosophy" if they are not hereby discouraged) is obviously equally science, religion, *and* philosophy—briefly, is commonsense.

e. The second member, $M(varying\ with)L^2T^{-2}$, is substantially the scientific member, and its obviously distinguishing characteristic is that it considers the Many *explicitly* in terms of L and T. In brief, science definitely and carefully uses space and time, and gets what it calls measurements—so that fundamentally and specifically science is the *explicit* form of Many expression (summing of course to a One or religion). That agrees with Kelvin and other authoritative scientists (§2c). But science customarily by no means confines itself to the use of that explicit form. Conventionally it spreads to the other forms, just as *This...* merges identically with *That...*. E. g., conservation of energy (i. e., the absoluteness of the One—or briefly, *The One=The One*) is religion—even technically mysticism, although quite intelligible,—and not *formally* explicitly science. And science is continually using the first member, the philosophical form; as in *Force×Length=Energy*; *Quantity of electricity×Voltage*; *Volume×Pressure*, etc. Further, every one of science's "mathanical theories" is definitely a philosophical form (§§88-90, 96, etc.).

f. On the other hand, orthodox philosophers and the average man are both frequently engaged in talking of time and space—in explicitly using those words to express measures definitely. In doing so, they are obviously technically scientific. As a matter of commonsense fact (i. e., taking a view of *all* knowledge, regardless of its forms), there can be no sharp distinction between science, philosophy, and religion, even in the matter of technique or form (for rigorous implicit proof, see §§41, 40, 50). The distinction which I more or less observe in this book is to consider that science treats primarily of the Many—and by implication, is explicit about L and T where need be,—whereas religion is explicit about the One. When I use *'philosophy'* I am inclined to follow customary usages of the average man, and imply a doctrine of some sort that is rather vaguely stated. I may say in defense of that rather untechnical conduct that to use *That...×This... is* more vague than to use $M(varying\ with)L^2T^{-2}$, and that with the exception of the few first class philosophers the professional philosopher, or particularly the amateur sort, *is* pretty vague. So the word *philosophy* is an uncertain, tricky sort of word to use. When the scientist means what is strictly technically philosophy—i. e., a *That...×This...* summed into a One,—*he* usually calls it "*commonsense.*" And that is just as tricky a word: it obviously has been saying "*philosophy*" for the scientist at the very time he claimed he was abjuring philosophy. Moses and the theologians, when *they* want to indicate what we see is technical philosophy, thunder "Thus sayeth the Lord"—which is even more dangerous and uncertain—now so glaringly so that the day of noisy dogmatism is rapidly passing.

g. The third and last member, *Energy*, is the tautological One word, and is the technically religious part of the equation. As a matter of fact, *all expressed* religion—when it is not mysticism and of itself unintelligible, ond hence not expression in a positive sense—is necessarily expressed in Many terms that are then summed into the One that is technically religion. So, the *expression* of religion is thus truistically a science—or it may be technical philosophy:- a mechanical theory. The science which directly expresses religion is usually called ethics (§160). Orthodox theology is fundamentally dualism, and hence is nonsense when explicitly considered, and actually in practice is neither science, nor philosophy, nor religion (as we shall see in verifiable detail). *Theology* is practically a spoiled word—so spoiled that in this book I make no perhaps hopeless effort to rehabilitate it, but use it in its customary meanings to indicate a certain dogmatic species of dualism, aristocracy, etc.

h. I shall use the word *religion* to mean that the primary emphasis of a certain state of consciousness or life or of a certain collection of words is on the validly formal and also intelligible—*and hence considerably emotional—summation* of the Many *into a One*. And I shall use the term with *one special implication*:- the summation must be a *complete* or *whole* One, and not merely a standard universe. (Words for summations that perhaps usually refer to *standard* Ones, and hence in such cases are not religion, are *education*, *art*, *culture*, and such; but those words can, and often actually do, indicate whole One meanings and are real religion, as shown

in §166.) Religion itself as being even more explicitly a conscious *meaning*, can not be *positively* expressed: the One words which indicate religion are not positive expression. So when I say *religion*, I refer to the fact that the definitely used Many words give a meaning of a *complete* One, and that One is religion—remembering that it or its really grasped meaning gives an appreciable emotional effect. That such a meaning is the One which for centuries has been striven for by orthodox religions, is obvious from the fact that all of them undertake to express definitely a description of the universe which might be summed into a complete God or One. That *expression* has mostly been dualistic and hence invalid theology; the orthodox religion itself, as understood or inarticulately held by vast numbers of past and present people, is obviously real; and the *expression* of the great religious teachers themselves (of Christ, Buddha, Confucius, etc.) was usually intelligibly or practically valid, although technically slightly vague at times (Christ, e. g., himself repeatedly asserted that he was aware of such technical vagueness in his remarks, by stating that a saying was for those with understanding, or for those who could receive it). —— When we come to observe the details of religion (§§153f, 162, etc.), we shall find that the more conventionally recognized characteristic of religion is that the meaning of the complete One must be sufficiently vividly perceived to make it what is called "emotional."

§40. a. Probably the most important conclusion asserted by our general equation is that there is not, and never can be, *any exact* science. All through the book I shall be showing just what that means, and proof of it. A brief intelligible statement of its meaning is that if momentarily we succeeded, by one chance in infinity, in getting the *exact* dimensions of (say) this sheet of paper, then at the next instant those dimensions would be inaccurate. Or, stated in a more technical way, there is not a single physical or "scientific" "constant," and can not be. There is no such thing as a constant or eternal atom, or a constant or fixed atomic weight, or "conservation" of a certain mass, or a fixed or eternal "person" or personality—*short of the total universe.*

b. An important, intelligible way of considering the fact that there is no exact science is to state it from the point of view of quantity—of 'how much.' To put it briefly, it is not possible to *express* accurately the quantitative solution of *any actual* problem. That is the same as saying that we can not *express* all the really ad infinitum dots of actual *That...*'s and *This...*'s.

c. *Quantity* implies that the time and space relationships of a *part* of the universe are meant: i. e., *quantity* means measurement. In the first place, measurement implies a standard unit—of time and space. It may be readily observed that scientists have never been actually able to designate any such units accurately. The length of a day—which gives the standard time unit:- one second—is observed to have varied in past centuries; and it varies slowly now (XII). There are carefully preserved metal bars representing the standard *L* (yard and meter): and they have been repeatedly measured and compared, and always with some slight variation. There simply does not exist any exact standard unit of any sort—and it is impossible for one to exist, short of the total universe (Part Two).

d. However, we are *acting*—as distinguished from verbally expressing—all the time in *exact* quantitative measure. To turn this page you must exert an exact amount of force. When you *turn* the page you do exert that force. If you had turned it a second earlier or a second later, slightly different amounts would have been needed (e. g,, the sun would have been in relatively different places with reference to the finite size of the leaf, so that the gravity pulls, or weights, of the leaf would have been slightly changed). This page is a ***This...***, with an infinite regress which must be *stated* completely in order to achieve verbal quantitative accuracy; and it can not be so stated. No man can state exactly how much force it needs to turn the page; of course, we can, for practical purposes, readily measure it with fair accuracy. But we are trying now to speak precisely, and by so doing avoid all the agnosticism and errors due to the vague and indefinite speech of past ages.

e. Consequently, we can *accurately* solve quantitative problems *only* by *doing* them—living them. We can, by learning the principles of measurement (principles of *L* and *T*), predict pretty accurately the measures. Thus, without an almanac, I can guess to within say ten minutes when the sun will rise tomorrow, and that is close enough for my purposes. The astronomer can anticipate to within about a hundredth of a second what the average of actual measures would be, and the navigator to about a second or so what his measures would be.

f. That may be expressed in a different way:- At first men expressed astronomy geocentrically—i. e., in terms of the earth as a stable or exact base, or scientific "constant" or standard. Then Copernicus found it more convenient—i. e., much more accurate *and brief*, if we use our customary language *consistently*—to express astronomy heliocentrically—i. e., with the sun as a base or constant. At present, with better observing, astronomers find the sun also "moving"—not exact—(so that it is unfitted to be a "center"): they tacitly more or less assume a fixed base somewhere, but do not know where or why. This book shows that no such center is possible; there simply is not any (so far I have shown it by an investigation of mere words; but later I give similar proof in terms of all other things). We advance from Copernican astronomy to an astronomy without a center—without an *exact* center. Similarly, conventional humanics usually takes a man as a base or constant; all our everyday talk is anthropocentric—man creates God in man's own image. We are going to change from that standard, and see that man is a sample of the universe—*is* the universe, if we speak absolutely accurately (§47). That makes the *whole universe* the center, which is logically and really the same as saying *no* center (cf. §§43-4). It is *actually* making a One God the standard or base: most of us have been claiming for many centuries that we are monotheistic, or believe in one God; now we are actually going to be, or do so. It will sound odd at first, although it is merely doing what the race has for centuries been claiming it does—and really has been doing *in actual living*. I have a profound respect for the wisdom of what, in the long run, people *do*—but not much for what they *say* about it.

g. To say that we can not solve quantitative problems accurately, meaning that we can not *express* or in any way *anticipate* the solution of them accurately, is obviously equivalent to saying that never can man anticipate his life exactly and thus be able to quit making an effort to live a better or more successful one, or stop being interested in *actually* working it out. It is an obvious truism that if science ever did succeed in doing what some over-enthusiastic second rate scientists fancy is possible—*accurately* predict some quantitative measures,—then in the degree in which those measures were important it would make a man's life a bore, take away his incentive to live, and in the same degree kill his nervous system. (*Qualitative* agnosticism and *quantitative* exact gnosticism both kill—ultimately *are* death.) —— To restate that about quantitative exactness in more familiar terms:- Suppose that a fancied-exact science had predicted

accurately the important things that would happen to us tomorrow: obviously, there would be no use living to verify them, as we already absolutely experience them *if* the prediction is *accurate*: so we would simply die, as a truism. It is a fact, perhaps not obvious in detail until the chapters on psychology and ethics (XVII, XVIII), that such accuracy would bore us to death. However, such a quest for accuracy is obviously a quest for the impossible. It is a waste of time or life to go after something which in the nature of things does not and can not exist (but we have to be careful that there is rigorous proof of such a condition: they told me that this book was impossible; and then when it was written that I couldn't find you, to read it; and again that it was impossible for me to print it—not to mention printing it at a reasonable price). Hence, we are, by clear seeing, finding just what knowledge we *are* after.

h. A qualitative problem is one which asks *why* or *how* or *what*. It asks an explanation. And an *explanation* consists of stating the relationships of things until we find some thing in the series with which we are familiar—fundamentally, a thing which is directly related to ourselves as a part; *is* a part of us (cf. Index, s. v. "Rebirth"). If an average child asks us to "explain" a cow he is generally satisfied at first if we say it gives milk—is related to milk in the capacity of producer. Not having disturbed himself with the verbal puzzles of the philosophers, he *knows* milk, and the cow is *explained*. Later, he wants himself and milk "explained." We are doing that in this book by relating *all* of the Many to each other, in a generally recognizable way. Explanation, then, means relating things, and direct observing of the related things as being so related, by the person to whom the explanation explains. That is circular, valid logic.

i. Already, in various ways we have observed that the Many parts of the universe are all mutually related. We saw that that principle was the underlying basis of our language. Consequently, all qualitative "problems" *are* explained. We *know* them all: it is the fundamental fact or principle upon which we started when we started to talk. Sometimes we may not see immediately the *expression* of the aspect of desired relationship between (say) cabbages and kings. I show the general relationship between cabbages and kings and everything else in §47; also, in detail in Part Two: to get the expression of other aspects of *any* relationship is mere verbal skill easily acquired—and to get fairly accurate *measures* of those relationships is the whole business of life. But the essential point is that we *know absolutely* that there *is* a universal relationship. We know it from merely our investigation, so far, of the typical sentence *That*...×*This*...=*Meaning*. The solution of all qualitative problems is represented or implied by any assertion of the One we may make—and we are continually asserting some One. So, speaking accurately, *there are no qualitative problems*.

j. Consequently, as qualitative so-called "problems" are the essential ones—the "riddle of the universe,"—we need never worry over any "unknowns." All the theological Veiled Beings, unseen Gods, "mysteries," "faith," etc., are like the exploiting patent medicine advertisements which in effect fool the dupe into believing he has a disease, and then into paying for an imaginary cure. —— Before we start doing anything, we can know positively and absolutely that the relationships—"causes and effects"—are going to hold, and that the affair is going to work itself out with quantitative perfection. The joy of living is to see just how closely we can anticipate and then realize those measures—utilizing them towards what we call our "wishes" or "will" or "purpose" (§§165-8). But we know before we start that there can be no perfect anticipatory guessing. —— That is a very rough anticipation of the solution of the problem of Good and Evil. We are here simply getting a general idea of all things, directly from observing language.

k. And we may note that the One and Many is directly exhibited or implied by "qualitative" and "quantitative." *Quantitative* is the Many, and is not accurately or absolutely expressible or "soluble," but is positively expressible with as great accuracy as we have time to achieve. *Qualitative* is the One, and is absolutely known and "soluble"—in conventional terms, is so absolutely known that it is not even a "problem,"—but is ineffable, and can be *expressed* only indirectly in terms of the Many. Hence, qualitative and quantitative are mutually contradictory. But the contradiction is formal, and not real; for it is obvious that there is a sort of double contradiction which cancels. —— Quantitative problems are often called problems of expediency, and their reasonably accurate solutions truistically change daily with the change in Many circumstances. And qualitative problems are problems of principle, the valid solutions of which are fixed and unchangeable, and which give the *general* way of solving the changing quantitative problems. An "opportunist" is a man who more or less ignores problems of principle—which obviously must complement and serve as the base of tolerably *correct* expediency. A theoretical man—one with a "single track mind"—is unbalanced in the opposite direction, and in actual practice is more dangerous than the opportunist, because he attaches One names—holy names—to his bad Many guesses.

§41. a. The phrase 'no exact science' is a negative form of statement. It is more easily intelligible in that form. At first a negative statement of anything is always more intelligible. For there are an indefinite number of things which something is *not*; and as we are familiar with many of the things which it is not, we can *understandingly* compare it negatively with those. But there is only one thing which a thing directly is; hence, we have to observe *it* closely and carefully, and more or less grow some new nerve structures to provide for directly understanding it (XVII). It is hard work to grow a little of new mind; often it is painful. Hence some people protest against going from the negative form of statement (which though easy to understand, is correspondingly hard to *apply*), to the definite positive form.

b. The first member, *That*...×*This*..., obviously is an explicitly implicit assestion of no exact science. The second member, $M(\textit{varying with})L^2T^{-2}$, is an explicitly implicit assertion of the *positive* form of expression of no exact science. That form is:- *mass varies with velocity*; or, in everyday language, a thing changes as its speed ('acts,' 'living') changes. That is the "fundamental law" of science; i. e., it *expresses* a form of truism to which *any* scientific statement may be rather readily reduced—which is what is meant by "fundamental law." We shall from time to time—e. g., throughout Part Two—see concrete evidence of its truth.

c. When we say that a body varies with its speed, we definitely mean that what is usually called its weight varies. The best quick, concrete proof of that perhaps is to observe that if a body moves fast it perceptibly rubs off (by friction) some of its substance, and hence has a continuously lesser weight (that technically is a static view; in moving through ether, the dynamic or 'gravity' results, in the opposite direction, are greater for ordinary bodies at a speed less than that of light—a complicated remark about measures that will require a thorough grasp of Part Two to understand—and only professional scientists have any use for it; the average reader will get the same thing in familiar subjects we discuss). At this point it might be asked how the weight

could thus change in an absolute vacuum: it will be shown that there is no such thing as an absolute vacuum (§§43-4, 100i, XI, XII). Scientists are now generally agreed, as the result of direct experimentation, that mass varies with velocity (specifically, that within certain limits electrons get perceptibly heavier as they travel faster; "Ency. Brit.," xxiv, 401; Millikan, "The Electron," 185, 251). We are seeing here, and shall later see in more detail, what it means.

d. The conventional law of conservation of energy is obviously a statement that energy passes from one part (or *M*, or unit of the Many), to another part, without changing the sum total of energy—i. e., without being destroyed and without growing. As we saw (§39e), that is a religious statement; it is the truism *The One=The One.* The law that mass varies with velocity is the Many statement of that religious truism, and asserts in effect that the parts *are* energy (i. e., are parts of *Energy*, or of the whole), and hence merely as a verbal truism, do change or vary when energy changes or "passes" from one part to another—all of which will be proved in detail (XI, etc.).

§42. a. The most definite proof of 'no exact science,' is the concrete or direct proof which we can get by direct observation of the fact that every unit of the Many changes. It is obviously the same proof as the carefully or "scientifically observed fact that mass varies with velocity (§41c). A more extensive statement of such experimental proof of no exact science—no "constant" units of the Many,—in modern scientific terms, is this:- All phenomena are observed to result in (or be) some flow of electrons from atom to atom (conventional science does not know about gravity in that respect, but see Index, "Gravity"). All parts of the universe are exhibiting some phenomena continuously—if nothing more than a transfer of heat. Electrons have weight. Hence, all things, even atoms, change continuously—or, are not constant.

b. Such observations were made by good observers centuries ago. Heraclitus asserted, as fundamental, that all things flow or change. He was called "the Obscure." It *is* a little puzzling at first to talk of things that explicitly are changing (although obviously that is only an infinitely small fraction as puzzling as talking of fixed things when it isn't so); but we are going to derive some very simple and understandable ways of being clear and intelligible in expressing our observations of that fact. We can't change the fact. And the modern scientific theory of relativity is the same sort of thing that Heraclitus noticed, and the relativitists have become perhaps more obscure than "the Obscure"; what they substantially do is to say that they will keep a *constant M* or formally fixed things, and then, in order to agree with obvious facts, will let *L* and *T* vary (§66). In our everyday language, as represented by the general equation, *L* and *T* are really relationship words, so that thus to vary them is nonsense *from an everyday point of view*, as we can not really have a relationship of a relationship. However, as we shall see, the relativitists make a new sort of language that in theory is valid; but in it each person has his definitely exclusive language; in it a second of time to you is not one to me, etc. —— Therefore, in noting that there is no exact science we are not discovering anything new. But we are arranging to keep verbally consistent about our observations, and to avoid both obscurity and unintelligibility, and also the untruthful assertion that some things are exact, "constant" standards which do not change.

c. The *expression* of the proof that there is no exact science has already been made by formulating our general equation. To say that there is no exact science is a mere truism of our way of writing that equation; and hence, so far as logic or form is concerned (§35d), we have, in agreeing to use such language, absolutely demonstrated the validity of the law. I need not repeat the details again. Briefly, we used the formal or *verbal* links *L* and *T* to get the arbitrary *That* and *This* together again—after it (they) was arbitrarily split by using *L* and *T*;—and we had to go into an infinite regress of such *formal* links (just as the classic logic was forced to use an infinite regress of its presumably *real* links). And that regress is obviously truistic with 'no exact science.' Hence, logically I have absolutely proved 'no exact science.'

d. We therefore see further, that in the equation the *This...* (or the *That...*$\times$*This...*) is by verbal agreement a generalized naming of *M*, which *M* is an arbitrary part of the universe (so that, as being the truism which we just saw in the last paragraph, the expression of any such part or entity at once demands the infinite regress if accuracy of statement is required). And we *assumed* (§38a) that *M* or *This* stated the same *This* pretty well if we stopped the regress with L^3T^{-3} (or L^2T^{-2}) instead of going on to $L^\infty T^{-\infty}$. Therefore, *our general equation is not exact.* Hence, if we definitely assert that it is not exact—and I do, and we are to understand that it is not exact,—then we *formally* cancel our previous assumption, and *the equation is absolutely rigorous in form, or logically, but quantitatively inaccurate factually.* —— We do not need to know anything about the *degree* of inaccuracy until we actually begin to measure—begin to try to *apply* the equation to particular circumstances, either in "science" or in daily life. In such cases we are then forced to *guess, literally.* We can never exactly know what degree, but in every practical problem there is, must *finally* rely upon our skill in guessing fairly closely before we act. It is thus absolutely proved that nothing can ever relieve us (or an atom, or a solar system, etc.) of the necessity of having that "personal skill" (for implications, see Index, "Teleology," "Personality"). That guessing is conventionally called by the polite name *judgment*, or by the even more dignified names *purpose* and *teleology.* The mildly offensive name *guess* is sometimes a safer one to use, and I often use it. (Quite probably I over-do the avoidance of all shams and pretentious euphemisms; I have been various sorts of snob and aristocrat in my time, and am probably now a snob at being no snob. For the general principles of such overdoing see §155.) —— It is obvious that this paragraph is a deliberate repetition of the substance of this and the last two sections. Yet a distinctly different logical point was stated in this paragraph—I explicitly asserted the end (*or* joining) of the logical circle, which is what makes this paragraph sound a bit too vague. You can at any rate see by the concrete example furnished by the paragraph that all this book is going to be a continual repetition of the solution of the One and Many. But I am going to bother you with these fine logical points only a very little—just enough to indicate that the word-quibblers can split hairs as much as they like, without being able to escape the rigorousness of our argument.

§43. a. We may now observe in more detail than in §30c the nature of *number*, and then at once observe that our equation explicitly implies the one single rule for keeping expression or logic consistent and valid—an important practical conclusion.

b. *Number* is directly observable to be the name of the most general way of naming the units of the Many—of naming the *This*'s and *That*'s. An ordinal number (e. g., 21st) is the specific name of the last thing or entity considered in a series of Many things containing as many as are named by the cardinal number (21). An ordinal number hence clearly

explicitly involves relationship: it sometimes is a relationship noun. But we shall not consider those distinctions in this elementary book; we take simply the broad generality that numbers are general Many names, used instead of *boy*, *tree*, *field*; we do not go into details as to classes, etc., and the standard universe number, which is 1.

c. It is obvious that if we begin to name the Many, using numbers as names, then the so-called number, 0 or zero, does *not* name a Many, but essentially denies that there are any Many entities. Consequently, it is obvious that 0 is not a number in the usual meaning of *number*. It is formally or logically a One word. Also, the name for the "very last number" is ∞ or infinity. But obviously, the concept of number as a general naming does not imply any such *end* to naming. Therefore, ∞ is is not a number, in the usual sense of *number*. *Infinity* or ∞ is the collective name for all numbers, and hence is a One word. Orthodox mathematics asserts ("Ency. Brit.," Art. "Mathematics") that 0 and ∞ are numbers. They are not.

d. Or, we may see in what is formally another way, that 0 and ∞ are not numbers. As a lower *limit*, *outside* any actual number or name for a unit of the Many, there is 0. And as an upper *limit*, *outside* any actual number or name for a Many, there is ∞. Therefore, obviously 0 and ∞ are not numbers, but are *limits* of numbers, which logically is an entirely different thing.

e. Or, we may see in another way that 0 and ∞ are not numbers. Obviously, ∞, in any intelligible and *explicit* sense, means *all* the Many, and hence means *continuous* or joined or unified. In that respect, it is clearly a One word. And 0 is a statement of a *no*-Many, and hence, *logically* at least, is a One word; with glaring obviousness it is *not* a *positive* Many word in form. In agreement with that and also par. c, we might conventionally say that 0 is a *null* Many word. Also, 0 does *not* name the One, in the usual sense of *name*; hence, it might with perhaps equal agreement with conventions be called a *null* One word. Hence, when I conclude that although zero is a *null* Many word and also a *null* One word, it is explicitly a One word, we need to see the definite 'reason' or truism for that:- It is said that 0 is a One word because we are taking it that Many words are *positive*—are explicitly language. (*Zero* does not actually *say* anything; it is ineffable—and for that reason a One word.) Consequently, when we have a null word, it positively is not positive language, and hence *is* a One word. —— The mathematicians ("Ency. Brit.," "Mathematics") failed to see that distinction, and consequently called 0 a number, and introduced an error that technically vitiates all of orthodox mathematics, as we shall explicitly see in this and the next section. —— We may see again, in a curious way, that this paragraph is consistent. The customary Occidental conception of Nirvana is that it is a universal nullity, or negation. It is a One, and it is zero. We of the West do not, in holding that, hold precisely the Buddha's view ("Ency. Brit.," iv, 744). But we are *practically* right in our idea of Nirvana, because Buddhism is a sort of negative language; and if language be reversed (as it may validly be, and as validly is substantially done in Buddhism), then 0 is *positively* the One (is Nirvana), and ∞ is the null word for the One. And obviously that reversal—which is merely *formal*—does not at all make 0 a Many word, or a number. Hence, the orthodox mathematical views as to "null" classes (l. c.) are inconsistent.

f. Hence, we say that 0 and ∞ are One words, and *are logically identical*. That means *formally* identical, of course. 0 and ∞ are "opposite" ways of speaking of the One, and although at first it may seem odd to speak of them as being formally identical, such nevertheless they are, as we shall see clearly in the mechanical model of language given in §§53-8. Also, that fact is the general or ultimate principle of "direction" (Index, "Direction"). Further, as the One is really ineffable, there obviously is not any *really* "opposite" ways of speaking of it, and hence we may use ∞ and 0 indiscriminately for it. *But*, the Many requires definite, positive words; and if we were to use 0 and ∞ in connection with the Many, even if they correctly meant that the Many was thus summed into a whole, they would mean that the summing was done in opposite directions; and that gives us *two* languages, logically identical, but in one of which "up" is named *up*, and in the other is named *down*.

g. Orthodox mathematics has two other concepts which it is continually confusing as being identical respectively with 0 and ∞:- (1) a very small number (an infinitesimal), and (2) a very large number. It is glaringly obvious that a very small number is not 0, and that a very large number is not ∞. "A very small number" and 0 are qualitatively or in principle absolutely contradictory—and similarly with "large number" and ∞. In this book, which as has been stated is much more rigorous than conventional mathematics, when I mean a large number or a small number I shall say so—generally saying 'indefinitely' large or small—except in a few negligible cases where it seems best for merely rhetorical purposes to follow conventional phraseology.

h. It is already obvious that in practice the only rule that we need follow in being strictly validly logical—i. e., rigorously consistent in *expression*—is to avoid naming *any* Many thing 0 or ∞, or by any of their numerous synonyms such as no, none, nothing, separate, distinct, all, whole, absolute, continuous, total, everything, perfect, God—and, on the contrary, to name *all* One summations by such words. Or, from another point of view:- we shall be validly logical simply by being *truly* scientific and always speaking of the Many as being measur*able* and the One as *un*measurable—*what* the measures are numerically being not a matter of logic, or general scientific law, but of practical life, experience, skill and good judgment or good guessing. —— That is the only rule, if it is taken for granted that no one is going to perpetrate the absurdity of making a relationship word—God the Holy Ghost—into a One word or into a Many word. Even the mathematicians sometimes do that (as shown in the next section). So perhaps we should always be more precise, and say that the *only* rule to be followed to achieve absolute consistency or rationality in expression is to avoid confusing the three sorts of words. Or, we may state that complete rule in terms of our equation:- (1) have *no* zeros or infinities in the first and second members (Many members), and *always* include one or the other in the third or One member; and (2) *never* confuse the relationship symbols with the One or with the Many names—never confuse a "process" with an "entity." —— Incidentally, the L and T in the equation are relationship symbols. As we saw in §30f, it would have been typographically more consistent to have made them similar to the symbols ×, =, etc. When we write $M...$ for $M(varying\ with)L^2T^{-2}$ we do become thus typographically consistent. And obviously, *That...* and *This...*, and especially *That...* × *This...*, *are* thus typographically consistent, the L and T being indicated by the dots, and not explicitly named by the same sort of symbol used for an entity.

i. That last paragraph completely states all the rules we need in order to be always consistent. The practical, everyday rule is the one about 0 and ∞. Most people (except when they try to talk of something of which they are largely ignorant, or when they try to be oratorical or appear

wise and important and weighty) by natural commonsense avoid making the confusion of relationship words. Only when they begin to dress up truth, or get off some ponderous piffle about the glory of SCIENCE do they become such asses. —— But when I put that practical rule in that formal and rigorous 'zero-infinity' guise it looks strange and hard to apply. So we may note its use and meaning in a little of familiar detail:- Suppose you are looking at what is actually a chair, and see it. Then, in order to be logical, you will refrain, first, from saying that it is not a chair—i. e., that it is a zero chair. Further, you will refrain from saying that it is a pig—i. e., that it is a zero chair, and that the resulting 0 is then multiplied by ∞ to make it *some*thing, and that that something, produced by putting in the ∞, is a "pig." And last, you will refrain from saying that the chair is everything, or perfect, or the universe—i. e., you will refrain from multiplying the actual chair by ∞, or calling it ∞ or perfect: you *can* validly say that the chair itself is inseparably *related* to the total universe, and hence in that sense *is* or becomes the One; but that statement uses *chair* in a One sense different from its common, Many, *actual* use we started with, and in ordinary honesty that One sense ought to be explicitly distinguished when thus used.

j. Obviously, the practical application of the logical rule is simple enough when we have to deal with a chair. It reduces to the rule:- say that a chair is a chair. It is only when we deal with numerous things that we begin to get confused, and to need the explicitly formulated rigorous rule. Obviously, it is *essentially* no more difficult to speak of numerous things than it is to speak of a chair. But the numerousness confuses us because it burdens the memory, and we need the guidance of an explicit rule. We see in the next section how even the mathematicians get confused because of not being conscious of that rule. —— But as a matter of fact, a large part of the logical errors of the world comes, not from any intellectual difficulty in being logical, but from the lack of courage and honesty to face facts as they are—and those are usually called emotional qualities (§155, etc.). It takes a strong man to be steadily logical—not necessarily a mathematician.

k. The practical rule of logic is so well known and "common" that it has, in another form, been taught to children for centuries; every well-bred person is supposed to conform to that rule. The rule is:- do not exaggerate [or if you do *formally* exaggerate, make it obvious to your hearer that the exaggeration is not really meant—and then, within certain limits, it gives a more vivid understanding, and is one sort of humor]. Exaggeration obviously is simply the making of things too small or too large, with a tendency to multiply them by 0 or ∞. One of the Ten Commandments is simply a partial statement of that everyday form of the logical rule (or *is* that rule, expressed in ethical terms):- do not take the name of God in vain. That Commandment clearly is:- do not use a One word as a Many word, or in such a context as to confuse it with Many words. The commonsense view of the matter is that if we have a language, it can be usefully employed as a good tool, and there is no sense in persistently misusing it. However, the human race have indulged in so much confusion of terms—really, in so much "swearing,"—that it is sometimes said that language is to conceal thought. E. g., the "gay and sparkling and brilliant" conversation at (say) tea parties, with its tinklings of "wonderful," and "perfectly sweet," and "perfectly intriguing," is swearing, just as much as are the casual "damn's," etc., of longshoremen. So we can reduce our practical rule to the homely one:- do not swear (except on the occasions you really mean it, and except as humor—and unless one's hearer appreciates the humor, it is not humor *to him*; also humor always ceases to be humor when it becomes too automatic; §162). —— You see, there is nothing esoteric about logic.

§44. a. We shall hereafter see numbers of instances of conventional failures to be validly logical—failures to follow the single rule that the three kinds of words must not be confused. The worst source of such logical confusions is the fact that practically every name in our language may be used as each of the three sorts of words. The name *God* is a conspicuous example. And conventional logical error consists in formally confusing the three sorts—just as the conventional Trinity has been confused and befogged until the average man feels almost a repulsion towards the very mention of it. As was stated, conventional mathematics does not follow the principle that the three sorts must not be confused; in fact, it sometimes asserts practically the contrary; so I am going to follow strictly the conventionally stated principles of mathematics, and "prove mathematically" in several ways the absurd result that any number is equal to any other number. That will show again that 0 and ∞ are not numbers and that we must not confuse relationship words with either One words or Many words. And it will prove the correctness of our logical rule, and also show that orthodox mathematics needs it.

b. Let c and d be any two *different* numbers, with difference e, so that $c-d=e$ . . (A)

Multiplying (A) through by $c-d$, we have

$$c^2-2cd+d^2=ce-de \quad . \quad (B)$$

Rearranging (B), $c^2-cd-ce=cd-d^2-de$ (C)

or, $c(c-d-e)=d(c-d-e)$ (D)

Dividing (D) through by $(c-d-e)$; or multiplying (D) through by $1/(c-d-e)$, we have $c=d$; or, *any number equals any other different number*, Q. E. D.,—which obviously, or truistically by our agreement $A=A$, is nonsense. The mathematicians sometimes, without giving any reasons, say that it is a fallacy to do as I did above, and divide (D) through by zero—by $(c-d-e)$, which is equal to 0, —or multiply it through by infinity—by $1/(c-d-e)$, which is equal to ∞. However, I am not able to find an assertion in any of the several varieties of mathematical books I happen to have at hand, that such a process is a fallacy; the closest to such an assertion I can find is the discussion of "indeterminate or illusory forms," such as 0×0, $0\times\infty$, $\infty\div\infty$, etc., wherein it is merely dogmatically asserted that those forms are, as such, indeterminate—thus implying that logically or mathematically they are permissible. —— On the other hand, mathematical texts all assert in effect, and usually explicitly if they take up the subject, that 0 and ∞ *are* numbers, and hence at least imply that it is just as valid to divide or multiply (D) by 0 or ∞ as by (say) 5—and such a process with 5 gives no absurdity. "The Encyclopaedia Brittanica" (xi, 303, referring to xiv, 545) clearly implies that there *are* actual numbers, *as values*, which are 0 and ∞—although usually ∞ means a large number which "tends to become" ∞ [orthodox mathematics thus clearly making the contradiction $A=A$ and A *is not*$=A$]. In its Art. "Mathematics" it explicitly asserts that 0 and ∞ are numbers; afterwards in the article (p. 881) the writer (Russell) does substantially deny it, and in effect, although a trifle obscurely, corrects ordinary mathematics just as we are doing here. But all the *explicit* authoritative assertions (technically, even that of Russell) are thus shown to be that 0 and ∞ *are* "values" and *are* "numbers." And hence, as there is no doubt that we can properly divide (D) through by any number other than those so-called numbers 0 and ∞, and as orthodox mathematics makes no distinction in kind

between 0 and ∞, and those other "numbers," it truistically follows that it is rigorously following orthodox principles to divide through by 0 or ∞. —— *c—d—e* is a null complete One—as is asserted implicitly by (A)—and the *valid* mathematical principle is that any sort of complete One is *not* positive language and (according to our primary agreement that $A=A$) can not be used *as positive* language, or as Many words; and when that One is related in any way (as by multiplication) with the Many member, that is equivalent to denying that it is a Many, or makes it a One (as all relationship is that of identity). Perhaps the briefest and clearest way to say that is to say that 0 and ∞ are not numbers. The absurd conclusion given above is substantially the same as those which are named the paradoxes of Zeno ("Ency. Brit.," "Zeno"). Only the explicit solution of the One and Many—which is what the rule concerning 0 and ∞ substantially is—will solve those paradoxes. And with that solution, the solution of those centuries-old puzzles is so simple that there is no need to give it explicitly here.

c. A series is orthodoxly ("Ency. Brit.," xxiv, 668) "a set of quantities *** arranged in order so that each quantity is definitely and uniquely determined by its position"; and it may be infinite—i. e., "the number of [those quantities or] terms may be *** unlimited." We shall use such series, again to prove that any number is equal to any other:-

By algebra, $1/(1+a)=1-a+a^2-a^3+\ldots$ (A)
Let $a=1$, and we have $\frac{1}{2}=1-1+1-1+\ldots$ (B)
By algebra, $(1+a)/(1+a+a^2)=1-a^2+a^3-a^5+\ldots$ (C)
Let $a=1$, and we have $\frac{2}{3}=1-1+1-1+\ldots$ (D)
And $(1+a+a^2)/(1+a+a^2+a^3)=1-a^3+a^4-a^7+\ldots$ (E)
Let $a=1$, and we have $\frac{3}{4}=1-1+1-1+\ldots$ (F)
Similarly we may get $4/5=1-1+1-1+\ldots$ (G)

etc., etc., etc.

The second member of (B), of (D), (F), etc., is a series; and orthodoxly it may be written out to an absolutely unlimited number of terms—may have *all* the terms there are, as a truism of the orthodox definition. Consequently, as those various series are, by orthodox mathematics, term for term identical *unlimitedly*, then obviously they are identical or equal, by our agreement $A=A$. Therefore, as the second members of the equations are equal, the first members are equal (by the same agreement $A=A$: mathematics says that they are equal by the "axiom" that things equal to the same thing are equal to each other), and we have:-

$$1/2=2/3=3/4=4/5=\ldots \quad (N)$$

By manipulating (N), and similar equations obtained by like methods, by simple algebra, we have:- $1=2=3=\ldots$,
or, *any number equals any other number.* —— Well; I did not *explicitly*, or technically by orthodox mathematics, introduce any 0 or ∞ into that "proof"—certainly not in the sense of "multiplying" or "dividing" by one or the other, which is sometimes superficially held by orthodox mathematics to be fallacious. But with orthodox mathematical rigorousness I managed to get an absurdity. In a sense (in the commonsense view taken by valid logic), there *was* an ∞ in the "proof":- the series had orthodoxly absolutely unlimited terms. By commonsense, the fallacy is of course that if the terms are unlimited or infinite in number, then the terms are *not* "definitely determined" as was asserted by the orthodox definition which I simply took at its word. The simple fact is that there is no such thing as a *positively* statable infinite series (there is no exact science). The series above, if they are made *definite* and *expressed* definitely, always have a fractional quotient as a last term, and evaluate definitely as $\frac{1}{2}=\frac{1}{2}$, $\frac{2}{3}=\frac{2}{3}$, etc., which are simple identities of *standard* universes—not of standard universes and absolutely infinite universes, as is orthodoxly asserted.

d. There are an indefinite number of ways of getting that absurd result by orthodox mathematics, all depending on confusing the One and the Many—in effect, on taking 0 and ∞ to be numbers, or confusing qualitative with quantitative. We shall now proceed to "prove" with orthodox mathematical rigor the same absurdity by confusing relationship words with the other two sorts. In this way we do not use 0 or ∞ in any ordinary sence:-

By conventional algebra, $[-\frac{1}{2}+\frac{1}{2}\sqrt{(-3)}]^3=1$ (A)
Also, by conventional algebra, $1^3=1$ (B)
As the right members are identical, then
$[-\frac{1}{2}+\frac{1}{2}\sqrt{(-3)}]^3=1^3$ (C)
Extracting cube-root of both sides of (C), we have
$-\frac{1}{2}+\frac{1}{2}\sqrt{(-3)}=1$ (D)
Hence, $\frac{1}{2}\sqrt{(-3)}=3/2$; or, $\sqrt{(-3)}=3$; or, $-3=9$ (E)
Adding 4 to both sides of that last, $1=13$.
And proceeding similarly by conventional algebra, *any number equals any other number.*

e. The trouble with those last orthodoxly valid equations is that I used relationship terms (the "cube," and the "square-root," and the "—" in $\sqrt{(-3)}$) substantially as Many terms (doing it an *odd* or uncancelled number of times; see next paragraph). It is obvious that there is no explicit principle in orthodox mathematics which says that that is wrong; but it nevertheless produces an absurdity. —— There are other well known ways of proving our absurd proposition by manipulating the "second power" (which involves a relationship), without introducing the —. The same absurdity is shown in another way (using geometry) in §50b; and in a general way in §66. We may note briefly that the symbol $\sqrt{}$ is a relationship term, just as definitely as is —. And of course it is as much nonsense to say and *mean explicitly* "the square-root of a minus," as it is to say 'the brotherhood of motherhood.' Orthodox mathematics itself agrees that it is meaningless to speak explicitly of the square-root of a minus—calling the "quantity" $\sqrt{(-1)}$ "imaginary." As a fact, we can not even imagine that "quantity"; it is absolutely inconceivable *if taken explicitly.* The same thing applies to manipulations of second "powers," third "powers," and all other relationships. A relationship can not be used as a One word or a Many word, or to 'duplicate' another relationship.

f. But orthodox mathematics *does* get correct results as a usual thing when it uses $\sqrt{(-1)}$ (and other 'relationships of a relationship'). The way in which that is done is by more or less unconsciously introducing another similar contradiction which cancels the first (and, with a little commonsense, rejecting the absurdity that results when it happens that that is not done—a procedure which glaringly shows that conventional mathematics is not rigorous). So long as there is a balance, an even number, of such contradictions in an argument the result will obviously be logically consistent: and the verbal or symbolic expression of such duplicated relationships may be considered, *not* as giving or in any way having any explicit meaning, but as merely a mnemonic device for keeping account of the relating process. In the same way poker chips have no special meaning or value of themselves, but are used as mnemonic devices to indicate the relationship of the players to the stakes. To puzzle over $\sqrt{(-1)}$ is equivalent to puzzling over the 'whyness' of a poker chip: there *is* no real whyness, but merely a convenient agreement. In identically the same way the ^{2}'s, $^{-2}$'s, etc., in our L^2T^{-2}'s, etc., do not *mean* two absolute verbal links or relationships, or any relationships of a relationship, but mean simply the verbal *way* in which space and time—the *single* relationship—is used in the language machine (see the total discussion of space and time in this book).

But as this is not a treatise on mathematical detail, I must here omit the volume or so of ways of balancing and otherwise handling such self-contradictory but formal duplication of relationship counters. Those mathematical details will be implied in the investigation made of our general equation.

g. The tacit, actual rule of conventional mathematics is that if its rules—which as we have just seen, are not complete—obviously do not work, then throw the result away, and with the same blindness try again. The savage says that if the lever at hand fails him, throw it away and try another. Actually, it is the only ultimate way to learn; it is still an excellent method; but it is good only in the absence of knowledge, for it is uneconomical of time and effort. Some professional mathematicians and scientists of a mediocre sort tend to believe that mathematics is perfect—the "queen" of the sciences, etc.,—and that if anything is expressed mathematically we must in submissive awe "believe" it, or at least pretend to understand it. Well; the reader has now seen that orthodox mathematics is no more certain to produce an intelligent result than is orthodox language. That "queen" stuff is obvious nonsense—the protective cloak of the egotistical dogmatist.

h. The important thing which we have seen is that we get absurd results in expression whenever one sort of word is asserted to be another sort. We have seen that orthodox mathematics needs a more precise restatement to make it self-consistent. We could at this point go ahead and translate the above simply expressed results into the technical terms used by *logistics*—which is mathematical logic, or what might be called the science of mathematical foundations. But I omit that; for I assume that most of us have more need for ordinary language than for technical mathematics. It takes more skill to say some given thing in words than it does to express it mathematically.

CHAPTER VI. *Names for logic, and chief application of valid logic to men.*

§45. a. We have seen a way of expressing a complete or unifying sentence or equation. And we have seen some important conclusions which were obvious from that complete sentence—finally seeing the simple rule by which consistency of expression can be achieved:- the three parts of the Trinity must not be confused. That rule was, for clearness and vividness, exemplified by showing the absurdities resulting from its non-observance by orthodox mathematics, which is presumably the most precisely rigorous sort of expression.

b. In the remainder of this Part One we consider the same things from different aspects, and in addition notice more or less interesting details. I shall begin this chapter by giving the most important general application in everyday life of our precise unification. After that we shall try to find a conventional name that fits the unification. To anticipate the results of that search for a name:- We definitely find by observing the meanings of various conventional names, the important fact that our valid logic and concrete truth is the same as the logic and truth of the average man —that the race for centuries has somewhat unconsciously been using valid logic and obtaining truth, naming it commonsense.

c. Then, I give in the next chapter (VII) a new sort of proof of our whole argument in a way which shows the indefinite flexibility and possibilities of language. Next I show (in VIII) a mechanical model of language, as concrete proof of the argument, and for more definite guidance in the use of language. Then (in the last chapter in Part One, IX), as an actual example of the fact that merely our investigation of language will enable us to unify knowledge rigorously, I apply what we have learned to elementary physical science, and we see its *formal* completion.

§46. a. Man is chiefly interested in man, because man is man and hence most directly and steadily perceptible and familiar to himself; it is merely a truism. Consequently, the most important application of the solution of the One and Many is its application directly to man. This whole book is with more or less directness engaged with that particular application. But now that we have the solution, we here at once apply it to man with explicit directness, in broad outlines. We see further details throughout the book.

b. It is held by the dualists that man is of two-fold nature:- soul and body. The soul is now usually considered to be the same as mind, or spirit, or consciousness, or the "vital spark." There have been many ideas as to soul (see "Ency. Brit.," Index, s. v. "Soul"). So many people have considered it some separate entity or thing which in some way dwelled in the body, that "souls" have rather gone out of fashion because it was so glaringly self-contradictory to consider the soul absolutely separate and also not separate, but more or less attached to the body; also, because no one ever succeeded in putting his finger on such a "soul," although many attempts were made. The modern fashionable name for soul is *personality*. —— Soul, or any of its several synonyms, is simply the unified or joined sum of parts of an individual, considered chiefly from a "mental" or "spiritual" or nervous-system aspect—as will be proved.

c. Some dualists further hold that there is a dualism—an unbridgable, unescapable, essential difference in kind or quality—between the "body" of man, and "matter." I. e., they hold that "body" is "alive," and "matter" "dead." We take that up in detail in the chapter on biology (XVI, especially §144; and it may be remarked that the matter of the old Clerk Maxwell style of scientist *was* viciously "dead" verbally—but erroneously; see Index, "Dynamic," "Maxwell"). Here, we simply note that that dualism—"vitalism" is the name of that variety,—and all others, will disappear in the same way as that between mind and matter is shown to disappear in par. f and following. We may anticipate here, that *all* the universe is "alive" in any real or One sense (or "dead," if it is preferred to talk lugubriously). Whether or not a given thing is, in everyday and Many language, to be considered alive or not, is a *quantitative* problem, the solution of which depends upon *what perceptible degree* of organization or structure or personality—what intensity of internal and external reactions—we *arbitrarily agree to require* of the thing that is to be called alive.

d. The orthodox way of "logically" bridging the dualisms *alive-dead*, and *mind-matter*—the way of Descartes, Aquinas, the Catholic church, and most other pluralists—is to use "God" as an entity, a concrete or Many link, or tertium quid to join the two. (In that sense, God *validly* should be a *formal* relationship word, God the Holy Ghost—in which case there is no dualism.) Other dualists do not like the name *God* and use some synonym. —— Some materialistic scientists substantially deny that there *is* any such thing as mind, or a real relationship or organization or personality or soul. In effect, they deny that there is (say) friction in a machine. We consider their views in detail later (Index, "Materialism"); in general it has already been shown that the classical logic which those materialists fancy they are using asserts some sort of relationship.

e. Obviously from the last paragraph, the dualists (excluding that queer variety:- materialists) do get mind and matter absolutely together. So essentially, all that their

talk amounts to, is that they assert that the two *were* absolutely apart until they (the dualists) themselves with super-Godlike power created a God to put them together. Hence, a commonsense question that obviously disposes of their talk is:- Why do the dualists keep on chattering about mind and matter being separate if they have been so good as to get them together for us? do they want us to keep on being grateful to them for having remoulded the universe nearer to their hearts' desire, and keep on appreciating their skill and miraculous power in making a God?

f. The obvious principle is that mind and matter are unified or related, and hence ultimately identical. The dualists by inventing their poor sort of God did not change the universe, and produce the relationship which they tacitly admit now exists. The shortest proof of the identity of mind and matter is that we attach some *meaning*—regardless of what it is—to the phrase "mind and matter": and a meaning is continuity or unity. If we didn't, obviously it would be nonsense to use the phrase.

g. In Part Two, where we observe matter in detail, we see that it is identical in all respects with mind, life, personality—except in quantitative respects, which are unessential. The formal proof in the last paragraph is of course rigorous; *any* dualism may be destroyed in the same way. But it is destructive proof. For actual, intelligible proof of 'no dualism' we describe things as they are.

§47. a. If we consider a man, superficially he seems to be a separated part of the universe; and it seems at first that we can not actually perceive that he is inseparably joined on to the remainder. But if we look closer (if need be, using microscopes, etc., as tools to intensify our perceptions), we can see that the man is not sharply cut off or bounded from the rest of the universe. His breath extends indefinitely inward into his blood and indefinitely outward into the atmosphere. His skin does not bound him; for his sweat extends indefinitely in, and vaporizes indefinitely out into the atmosphere. There is obviously no definite place at which his food and drink become a part of "him," or cease to be a part. Obviously, it is not possible to say where the man begins or ends. Like our circular logic, which starts from truisms and ends in them and stays always inside such a verbal One, the man *ultimately*, or in *exact* language, has no positive beginning or end, or sharp boundary. A man himself is precisely like our valid logic.

b. We can at this point be somewhat more definite about his mind and body (see XVI and XVII for remainder). It is observable that if we remove part of his nervous system we remove part of his mind. So obviously, in that rough way it is shown that there is no essential difference between mind and body. Also, it is not possible to observe any *exact* or positive boundary between the nervous system and the organs in which it "terminates" (§152). Any tool which we take in our hand (say), is obviously a *perceptible* extension of our body or nervous system or mind; for no sharp boundary may be distinguished anywhere; and very evidently we can—with the ordinary tool—feel or observe perceptibly *with the outer end* (§165).

c. Except for *rough* statement that he is a *This*, the man is really continuous with the universe—inseparable from it. He is actually *This...*; any unit of the Many is actually *This...*, as we have seen in "theory" and are now broadly seeing "concretely." If we try to assert that the man is at least bounded by the surface of the earth or by the atmospheric boundary, a closer look will convince us that the assertion will not hold. For obviously the air and the water on the surface of the earth (*and* some of his vaporized sweat, etc.) extend *into* the earth with all degrees of perceptible connection. And the air does not stop at any outer boundary. There is an outer zone of attenuated air from which parts (molecules) bounce up, and mingle with similarly bouncing gas from the sun, and so on. We *see* that continuation of the atmosphere in zodiacal light (§121). And in turn, it is observable that parts of the solar system mingle with other such systems, then on to other galaxies, and so on indefinitely or in infinite regress (XII).

d. Therefore, the so-called individual man is an *arbitrary part*; for no *exact* boundary can be fixed for him in any way, short of the total universe. And even if we were to fix a formal boundary for him as a definite "individual," with glaring obviousness that boundary would constantly change. Every time he breathed there would be a continuous cycle of change; his heart beat usually moves parts of him perceptibly in and out; the ingestion of substances constantly produces changes. Obviously, even such a formal boundary is not definitely or positively fixable.

e. Therefore, from every point of view the man is simply arbitrarily a unit of the Many. In terms of the Trinity, he is, considered roughly and inexactly, a God the Son. The *only accurate* boundary we can give him is to say that he is ultimately, without any real break in continuity, the whole universe, or God the Father. *Explicitly, each man*, when accurately described, absolutely includes in himself all other men and things as parts of him, and *is God*. That is the most intelligible description of God (particularly God the Father) that can be given. The description is thus far very thinly intellectual—i. e., mostly formal and abstract;—this whole book adds details, and under ethics (XVIII) we get some small measure of its actual infinite emotional content.

f. The conventional "belief" of the dualists is that God is something *outside* the "universe," separate from it, and absolutely apart. Obviously, as a truism, if God *or anything else* is outside the universe and apart from it, our very assertion of the existence of that extraneous thing implies an assertion:- 'the universe *and* it.' And that assertion, by the '*and*', explicitly asserts a connection so that 'it' is actually implicitly a *part* of the universe and included *in* it (or else the phrase is utter nonsense and unintelligible). In short, it is absolutely self-contradictory to assert that we are even aware of the possibility of anything extraneous to the universe or separate from it; we *can* write such a *form* or assortment of words, but the form is self-contradictory and pure nonsense —or else it implies some new and novel meaning of the words used. —— I might add a volume of the same sort of obvious proof. But the foregoing part of this paragraph is rigorous, and is sufficient for the intelligent reader, in spite of the wide currency of the yarn that God is outside the universe. God *is* the universe.

g. To take another point of view of the last paragraph:- There is no "something" exterior to the universe with or by which to describe the universe's boundaries. I. e., the universe is not a *This*, which we can speak of *positively* and explicitly (as we can of the color red) by comparing it with a *That* "outside" or even *formally* different or separate. The universe is the complete "finish" of all different *That*'s and *This*'s, and has *nothing* by which to fix its boundaries (except that they include the sum of everything inside): in everyday language, the universe is not "bounded." It is *not quantitative*. Consequently, when we achieve complete accuracy by describing a man as ultimately the universe or God, there is no way of expressing any boundaries or size, in positive words (see Index, "Difference surface"). We are *really* truthful, 'essential,' qualitative, and accurate then; but we are indefinite, and not *verbally* positive. The universe or God or any ultimate thing is ineffable or mystical, or is

quantitatively absolutely indeterminate, or is really *infinite*.

h. Thus far we have seen rigorously—in formal, thin intellectual expression at least—that a man is arbitrarily an individual or unit of the Many, and in ultimate reality is the universe or God the Father, or the One. It is now similarly obvious that "*man*" as a class is a word which implies the relationship of all individual Many men. In that sense, *man* is God the Holy Ghost, or a relationship word. That use of *man* is rather common; the more explicit names for the same relationship, which also include an implication of a Many meaning, are *mankind*, *brotherhood of man*, and *society*. The science of sociology emphasizes that point of view of man as God the Holy Ghost. All governments and other human organizations obviously take the point of view that man, from one aspect, exhibits relationships—is God the Holy Ghost. So the solution of the vexed problem in sociology of *What is sovereignty?* is obviously:- sovereignty is the name of that relationship (is a relationship word); and various "sorts" of sovereignty are nothing more than such a relationship of "natural" continuity or ultimate identity, observed in various *perceptible* quantitative degrees of extension and intensity in various historical circumstances. —— When it is said "God is love," fundamentally it is meant that man as God the Holy Ghost is a linkage or unbreakable organization or organism called *love*. The same "connection" in "science" is called "cause and effect"; or cohesion; or, negatively, pressure (§86). In philosophy and theology the relationship aspect is called reason, and mind, and the "moral sense," and "spirit," and teleology. The chief difficulty in orthodox doctrines is that there is such an everwhelming profusion of names for that same thing. For centuries theologians, scientists, philosophers—prophets—have come forward with "systems" or "truths"—special or particular ways of unifying knowledge,—each thinking that he had some bright new idea, to which he often gave a new name and said it was the most "important" thing in the world. All of them were talking about the same simple thing:- God the Holy Ghost—or copulas in language; or the relationship of the One and the Many. And all of them obviously were fundamentally right, even if they were a bit narrow minded and over-proud of their new little names.

i. When in everyday terms we speak of a man as having personality, we obviously mean that he is strongly consistent; i. e., all of him hangs together or works together so energetically that it all "adds together" instead of there being appreciable mutually conflicting and hence neutralizing parts; and hence he is on the whole vividly perceptible. He then is not futilely vacillating, or noisily contradicting himself, or awkwardly "falling all over himself." Hence, even in conventional meaning *personality* substantially is perceptible relationship—a definite continuity inside a given man as a standard universe. Obviously, when we consider man as a complete universe, personality is still God the Holy Ghost. Or in that relationship sense, and also in the sense that a man is accurately and ultimately the One, *God is a person*. That is not using *person* in quite a conventional sense, which latter sense usually makes a person a *standard* One (vision being too short conventionally to see a whole One), and hence in practice makes God a sort of senile gray-bearded Oriental or Prussian kaiser seated on a sort of unsupported gold throne nowhere in particular. But obviously, our conclusion that God is a person uses *person* in its essential conventional sense of continuous, or organized, or connected; we agree completely that a standard universe may have such a personality, and note that in it the personality, to our rather restricted vision, may be perceptibly much more vivid than is the personality of the whole universe (almost stupendously so in the case of Christ, e. g.): but it is quite evident that the facts show that the whole universe is also a person. —— I may make the technical philosophical remark, that in that sense the present sort of deism truistically is practically opposite to the customary historical pantheism. That pantheism usually was substantially nothing but what we now call materialism (§49h), with a silly, cloying sugar coating.

j. It is to be kept in mind that consistently with present conventional language, God is a person. I. e., the universe is organized, connected, *organic*—"something more" than a mere "heap" of parts or Many. The universe is a *real* machine—one held together by friction (or *love*, if we prefer the ethical term; or *cohesion* or *force*, to use scientific terms), and is not a heap of disparate parts. *The machine works. It is a person* (§§144, 153). An ordinary locomotive has a personality quite perceptible to me: in principle it ought to have slight personality, as we shall see by the whole of Part Two. Many people have asserted that they can perceive the personality of a locomotive or similar machine—as witness the affectionate name "tin Lizzie" for a Ford car.

---

§48. a. We have seen that nearly any name can be used for each of the three sorts of words (§§28h, 29, 30, 43-4). We have seen it vividly in the case of *man* (§47). And we saw by the absurd mathematical conclusions that the confusion of the three produced nonsense (§44). It is therefore evident that to be consistent or rational—to see things as they are,—we distinguish in which of the three meanings we are using some given word, so that mere names shall not confuse and blind us while we are ostensibly using them to avoid that:- to aid our memories. Any normal child can readily judge which of the three meanings of a given name is intended, or else see that in a certain case he can not and hence that the word or sentence is unintelligible to him. There is no intrinsic difficulty about being logical, and seeing the truth: the difficulty is that we are in the *habit* of confusing the words.

b. It is further evident that by considering *any* name ultimately and accurately as designating God the Father (as may be validly done), we therein have a formal religion that is really correct, as it *means* or indicates the whole related universe. Obviously, as a further truism of that, any person who considers and observes that the results of his activities are an inseparable part of the whole universe, and are needed as that part to round out the whole, they being absolutely indispensible because inseparable—any person who can thus regard his activities or his life has a real, everyday, working religion even if he is no more than an unskilled laborer (for further details and proof, see §§166-7). Theology does not necessarily express a valid religion. If you will refer to an authoritative orthodox theologian's statement of what theologians think is the Trinity ("Ency. Brit.," vi, 284-5, in Art. "Christianity"), you can readily see, in the light of what we have now observed about the Trinity, that no so-called Christian theologian, according to that statement, has yet consistently expressed any valid religion. If it is not obvious from that short citation, then the remaining pages of the article cited make it more obvious. [48b] Many theologians

[48b] That article (p. 289) explicitly states in effect that the theologians are *evasive*—i. e., that they will not agree to say that $A=A$ and stick to it, nor yet will they refuse to do so (cf. §22). E. g., the writer states that *officially* both the Protestant and the Catholic churches assert certain doctrines which many scholars in the church find "no difficulty" in rejecting and "remaining Christian." He says that they produce a large literature "reconciling science and theology by softening and compromising and adapting"; that men are not "prepared to carry principles to their logical conclusions. By

of course have a valid religion, and have had. I have merely pointed out that by their own statement their *expression* of such religion is grossly inconsistent. Yet that theological dogma, worthless when strictly interpreted, implicitly points out the complete truth. So obviously, theology need not be taken more seriously than any other science. And orthodox theology is explicitly wrong when it pretends to any "authority" (such pretension being substantially the invalid claim that *expression* is real proof; see §35). Also, theology is, in making such a claim, an aristocracy, autocracy, or kaiserism. The Catholic church explicitly pretends to such authority (ibid., Art. "Christianity," 289); hence, the Catholic church is absolutely wrong by its explicit words in that respect (which is an important practical one), and is in principle intolerable (§169).

c. In the old days the Trinity was a governmental problem. It is now the verbal custom to consider that in some countries there is no religion in government. Obviously, in a complete sense, we can not possibly keep religion out of government: man himself is clearly the Trinity, and man is society. But what is meant is that we keep theology out of government (allowing free speech in the matter—as theology, with its claim to "authority," will not willingly do)—which is quite right and practically necessary until such time as theology becomes a valid science (when it itself will accord such free speech; §169f). As a matter of clearly obvious historical fact, the reason this country removed theology from politics is that theology is essentially aristocratic or autocratic in its substantial claims and in its practical tendencies—a so-called "spiritual" dualistic doctrine of kaiserism that can not possibly be reconciled with democracy in principle, it being the flat contradiction of democracy—as we shall see proved in detail in XVII-XIX.

d. The historical fact, with an obviousness that is painfully glaring to me, is that most churches, and especially the Catholic church, have opposed any verifiable, objective proof that certain of their dogmas failed to agree with things as they are. Theologians have tried to force men to accept their "authority" even to the irrelevant point of torturing them bodily. For historical proof see the Catholic Walsh's officially censored "Popes and Science," where the facts glare through his formal denials and "explanations"; or, for explicitly stated proof see White's "Warfare of Science with Theology" (note that White advisedly says *theology*), or Buckle's history. —— The reason for that insistence of theologians upon their "authority" is of course the same as the reason for the maintenance of any kaiserism:- it was a more or less selfish, personal effort to get and keep themselves in a position of power and privilege and "emoluments" (i. e., graft)—and of course their doing so did confer some very temporary benefits on the laymen (e. g., it saved them the pain and effort of doing a little thinking for themselves, giving them the lazy comfort of saying that those subjects are of course outside our line and we will leave them to the specialists—just as some presumably intelligent people have talked to me about this book); and those temporary comforts were paid for later by mental and moral deterioration, as is all kinds of paternalism or parasitism (cf. Part Three). It is much easier to claim to be right (especially after one's brain is so debauched—i. e., partly killed—by the evasiveness described in the footnote, that it no longer rebels against such dishonesty), than it is to dig into things by hard effort and find out what *is* right. Consequently, so long as there are men so weak and stupid as to tolerate being duped (and even actually to invite it, as has come to my notice repeatedly in working up this book), there are going to be dogmatic theologians, as well as other sorts of dogmatists, who are mentally sufficiently depraved to dupe them. The dogmatist pays for the "privileges" and graft he gets by suffering that brain destruction—a very expensive payment, although he in turn is too stupid to know what is

a fortunate power of mind they are able to believe as truths mutually inconsistent propositions." The writer goes on further, actually approving that extraordinary refusal of theologians to abide by any verbal agreement they may make. Obviously, he asserts in effect that a theologian will agree that $A=A$, and will then at any time he likes, and without notice, assert that A *is not*$=A$. —— That writer is an authoritative Protestant (whose name in simple kindness I omit), and perhaps the Catholics may hold that he has no right to speak for them. So we shall let the Catholics exhibit fundamental evasiveness for themselves:- If you will refer to the Art. "Philosophy," in the authoritative "Catholic Encyclopedia" (xii, 37-8), passed by their censor, you will find that its official Catholic writer (in an extremely confusing manner which may have confused even himself —and which on the other hand may have been sophisticated guile to prevent anybody's pinning him down, which is the acme of evasiveness) dodges definite statement of what the Catholics fundamentally believe as expressed in philosophical terms, and finally makes this "shifty" statement as to official authoritative imposition:- "The Church has never imposed any philosophical system, though she has anathematized many doctrines." [That of course is equivalent to asserting that the church has negatively imposed philosophical systems—but let that pass.] But another writer in the same official work ("Cath. Ency.," v, 170) substantially flatly contradicts that first writer by stating:- "From the thirteenth century, through the influence of Albertus Magnus and still more of St. Thomas Aquinas, the philosophy of Aristotle, though subjected to some important modifications, became the accredited philosopby of the Church"; and, "The distinction between the buman soul and the body it animates was made clearer and their separability emphasized; but the ultra-dualism of Plato was avoided." An authoritative Catholic theologian, Ryan, in a more or less casual book not officially recognized by the Church so far as I can discover, asserts as a sort of matter of course and as actual practice, that the Catholics are dualists ("Socialism: Promise or Menace," 261-2); and he goes on to make the nonsensical dualistic statement (which in actual practice Catholics claim to hold), that "science and religion as such *** deal with entirely different spheres of reality,"—which remark of course implies as a verbal truism no need of consistency between science and religion. Also, J. J. Walsh, in "The Popes and Science," officially censored by Catholic authorities, states (p. 327):- "At the end of the nineteenth century Leo XIII. crowned the tributes which many popes had conferred on Thomas [Aquinas] by selecting him as the teacher to whom Catholic schools should ever turn by formulating the authoritative Papal opioion—the nearer to Thomas the nearer to Catholic truth." And see also Walsh's "The Thirteenth, Greatest of Centuries," pp. 81, 276-81. —— It seems to me that those quotations prove both sorts of theologians to be officially evasive, irresponsible and unreliable in their assertions—or else to have minds of such weakness of perception and hence unreliability as perhaps occasionally to border on pathological insanity. The Germans repudiated a "scrap of paper," and the rest of the world would not tolerate it—it is becoming bad taste, and sometimes dangerously unhealthy, for even statesmen and diplomats—a "government"—to lie in these days, although Henry Adams says in effect that they feel quite free to lie. We here see the theologians acting even more reprehensibly than that defunct German government—for that government was at least honest in giving notice that it did not propose to keep its word unless convenient, and those theologians in those quotations evade even that much of explicit statement of how far we can rely on them. As a matter of fact, if the Catholic theologians are ever forced to notice these remarks, quite probably they can "prove" by technical canonical law that I prove nothing officially by such quotations—a characteristic Catholic procedure (e. g., see Walsh's "The Popes and Science") which if followed proves my point. There is actually a history extending over centuries, of theological lies and evasions: see "Pious Frauds" in Lecky's history of the "Rise of Rationalism in Europe." And the Protestant theologian quoted goes so far as to assert that none of mankind will live up to their principles: the truth is that most theologians even have excellent principles and live up to them quite honestly as a usual thing. —— So far as I can find, all other classes of men try to be verbally honest. Even the first Catholic writer quoted above makes a sort of verbal claim to the intended honesty of Catholics in dealing with science. But in view of those quotations, I have no choice but to state that in no case in this book do I place any particular reliance upon what a theologian professionally or officially *says*.

hurting him, and fills the air with complaints about the "unbelief" of the people. This book will show unescapably that we *pay* for everything we get, and *get* everything we pay for. In the aristocratic kaiser-theologian-dupe game the payment is merely a trifle slow—and that fools boobs.

e. The *extent* and intensity with which we perceive the ultimate unity or organic personality of the universe determines its mental effect upon us (including emotional effect), and hence its worth (§168). The remainder of this book is a series of evidences that there is such ultimate unity or connection or love or cohesion. In that sense the book expands and intensifies the reader's religion or enjoyment of life if he sees and verifies that evidence for himself.

f. The argument of the book is now complete. It was complete when we had examined the sentence 2+3=5 in §12; but now all implications of that form have been stated and shown in a broad way. Hereafter I simply repeat the argument in terms of different sorts of details, as a means of making it applicable and more thoroughly intelligible. Having now achieved that general completeness, it may at this point be of interest to see what the conventional name of the argument is:-

§49. a. There may be said to be three general historical ways of viewing—interpreting—the Trinity ("Ency. Brit.," Art. "Christianity"). [49a] Each of those historical interpretations consists of emphasizing one sort of our three sorts of words, at the expense of the two remaining kinds. Sometimes the emphasis is so violent that the other two members of the Trinity are claimed to be non-existent. Thus, the atheist or the materialistic scientist emphasizes the Many so much that there is to him nothing else—no unity, no God, but only "a fortuitous concourse of atoms" (an obviously self-contradictory phrase that thus implicitly re-establishes the Trinity). Or, the technical mystic will so violently emphasize the One (or may be it is relationship or God the Holy Ghost: no one ever knows just what the technical mystic *is* saying), that he substantially denies the existence of the Many. And there are other varieties of doctrines that wholly deny one or more parts of the Trinity. Sometimes people become exasperated with the theological dogmas, as Wells apparently did, and deny the Trinity in toto—and then more or less unconsciously construct another, with new names. But as we have seen the formal need in language of each of the three sorts of words, it is obvious that the truth is not any of those doctrines which deny one or more parts, either very largely in a quantitative way, or wholly—in really a qualitatively impossible way. So technically, we are neither Christian Scientists nor theosophists (two species of mystics), nor atheists, nor materialistic scientists (who are almost German "monists")—not yet agnostics, who say they know little or nothing of the matter.

b. Nor are we dualists, who undertake to make some real split in the Trinity, so that any two parts are "perfectly equal" to each other. The parts are not real or essential or distinct, but merely arbitrary or verbal, and actually merge into each other even in the using of such logical formal distinctions.

c. It is not profitable to examine at length the names of the doctrines that in one way or another gave greater emphasis to one or two parts of the Trinity than to the remainder. There are already hundreds of tiresome books on the subject. We shall look at a few important doctrines.

d. The Buddhists seem to me to make relationship words—explicitly *time* and its numerous substantial synonyms—the most emphatic of the Trinity. I. e., they make relationships or God the Holy Ghost "*real.*" (For rhetorical purposes I tacitly take it for granted that I am historically correct in my interpretations. I am not able to make out with much definiteness what the Buddha did mean, and I doubt whether he knew very clearly himself—there are places in this book [they are labeled] where I do not know clearly what I mean; e. g., the full extension of the theory of harmonic periodicity: and I know considerably more about things than the Buddha did. All my historical statements are similarly liable to error. Such statements are quantitative, and I can do no more than give reasonable guesses, some of which are most likely to be very inaccurate.) —— To make relationships real or truth, is, truistically, valid, provided that there is at least formal recognition of the logical existence of the other two forms. I. e., we validly can emphasize relationships very much—say they are "*real*"—and at the same time say that the other two forms logically exist, but will verbally be called not "real," but "arbitrary" (*real* and *arbitrary* in that usage merely take on quantitative meaning). The Buddhistic way of making *time real* (doing so in practical effect by emphasizing the long temporal duration of training or education, or what they call the "way," to ultimate perfection—to grasp of the One) obviously makes the One a form—it makes the One what we may call a 'negative reality,' or Nirvana. —— Buddhism is hence obviously quite right; it does not deny the formal or logical need of those three forms, and their ultimate unity. But we Occidentals do not talk that reversed language (it is in practice an Oriental, more 'selfish' [cf. §151), introspective language; whereas we prefer an objective or "scientific" language). So Buddhism is inconvenient for us—and also possesses inherent tendencies towards selfishness which are inadvisable (e. g., the conduct of the Buddha himself in coolly deserting his family would get him a jail sentence in some of our states), and are technically and historically primitive. —— In speaking of Buddhism I refer to the original Buddhism, which was essentially sound, and an extraordinary advance. The Buddhistic theologians seem to have perverted Buddha's teachings as ours have Christ's.

e. Those who emphasize the *Meaning* or One or God the Father member of the Trinity are now perhaps most often called *monists.* The chief objection to that name as a proper name for our valid logic is that its German users, in their exaggeration of detail (of the Many, of "material"), have rather spoiled it. They usually call their doctrine "scientific monism," and fail to recognize that the phrase implies a dualism of "matter" and "spirit" that instantly stultifies it. Some theologians in a somewhat similar way try to appropriate the name *monism* as being more up-to-date than the ancient equivalent theological term *monotheism,*—and then make a dualism out of their "monism." Or, the Germans are sometimes equally shallow in asserting what they call a monism, that in effect denies relationships (so that they can formally use the elassieal logic with it); such monism again implies dualism. —— Before the war I used to devote considerable space to showing that Ostwald and Nietzsche, who seemed to be the Germans' actually accepted leading "thinkers," were exceedingly unsound fundamentally. (I am aware that Nietzsche attacked Prussians—in a way which was really complimentary in *their* view—and that Germans verbally often repudiated him. I

[49a] The writer mentions four more technical ways as being "Christian," but I shall ignore such technical dogma as being too trivial for intelligent readers. E. g., the Catholic Trinity is briefly this:- "In this one God there are three distinct Persons,—the Father, the Son [i. e., Christ], and the Holy Ghost, who are perfectly equal to each other" (Cardinal Gibbons, "The Faith of Our Fathers," Chap. I)—and I take it that the reader of this book is too intelligent to desire a discussion of such balderdash, that is so glaringly self-contradictory and meaningless if explicitly considered.

think however that in view of the psychological principle shown in §155, it is reasonably correct to say that Nietzsche expressed German general views:- they being chaotic and selfish. I also recognize that Nietzsche was tremendously in earnest, and was actually likeable in many ways on that account; and that he was a victim of his time, and hence deserving of much approving pity by really intelligent persons. As we saw in the case of the Kaiser (§25c), if we take an ultimate One view of Nietzsche, he was completely consistent and beautiful. I am however restricting my remarks about Nietzsche to what he actually wrote; and that was a violently emphatic dualism and hence perceptibly insanely incoherent.) But now that the war has occurred, I judge that any extended proof of German unsoundness in principles, due to too much emphasis on detail or the Many, is no longer needed—just those very general remarks about German monism being all that is needed to call attention to the facts. Those remarks show, what will probably be accepted as the historical fact, that the Germans did not as a rule grasp any real meaning of the One, or couldn't generalize well (and hence talked loudly and sentimentally of being monists because essentially they were so far from being such; for the psychology of that see §155); although they were very industrious and prolific with details of all kinds. That detail work they did well, and it is of great value. From the point of view of their own best interest, they did that detail work too well, becoming unbalanced in it (cf. §149).

f. Consequently, although *monism* is thus a somewhat spoiled word, and gives conventional misleading indications, it may, if stripped of those conventional accretions, serve as a poor name for what we have observed to be the truth—subject to another defect to be mentioned in par. i. For it is an observable fact that Occidentals have acquired the tendency to consider the One, or a unified God, to be the "reality" or "truth" whenever there arises any *definite* question as to what is "real." That seems to be the result of several centuries of a religion that in usual practice tended to be rather monotheistic (or without a "center," or formally not anthropocentric) if it were explicitly pinned down to definite statement (and Occidentals formulated such a religion because they appreciably had greater mental or general vigor than the Orientals, and that in turn had many causes, climate being the verbally final one—Index, "Climate"). E. g., the ignorant Catholic layman substantially has five coordinate Gods (Christ, God the Father, Holy Ghost, Virgin Mary, and a null-God, the Devil), and the Protestant Trinitarian usually substantially has four Gods. (As people lose in mental vigor the number of their Gods increases, that being merely truistic with inability to see the relationships that give unity; hence it is another truism that the numerous Catholic Gods appeal to the ignorant who can't or won't think for themselves.) But if either layman is pinned down to an explicit statement he will verbally assert one God, in spite of the glaring fact that the assertion contradicts his ritualistic practices. But in spite of those practical vagaries —they are emotional or ritualistic (§167d) survivals of that ancient day when men were too weak mentally to see and express considerable unifications,—whenever a question of formal speech or explicit logic comes up, the Occidental has become accustomed to asserting a unified universe or God, and as a result our whole language is *formally* permeated (cf. par. j for actual *practice*) by the implication that the One is "real" or "true," or that monism or its theological synonym monotheism is the truth. —— And to repeat, that monotheistic "religion" did not absolutely "cause" Occidentals to progress ahead of Orientals; the Occidental progressed because he was able (for reasons we implicitly see in numerous places below) to get a wider grasp of the connections of the Many. He *stated* that grasp as monotheism, and that religious *expression* in turn reacted as a "cause" that widened the grasp, and so on in infinite regress.

g. There remain those people who emphasize the Many part of the Trinity—substantially saying that the Many is most important, or is "real." The more usual name for them is *pluralists*, meaning finite pluralists. A name nearly as common is *realists*. Probably most people who are said to have "scientific" tendencies are what are popularly called commonsense realists; i. e., without much investigation they take as being "real" what the theologians call the things of this world. We have seen that the Many *is* formally or logically true; hence, those names for truth may serve as poor ones except that we have to be explicitly *infinite pluralists* (a verbal self-contradiction of course—needed on account of the fact that the Occidental names things as stated in the last paragraph; see also §24d). However, we see better names in par. i. —— There is one special objection to calling the Many real, and the One arbitrary. We are in the habit of calling the One real, and to call the Many always real turns our customary language topsy-turvy (and fundamentally is perhaps the most important, theoretically superficial but intensely practical, cause of the warfare between science and theology—which is hence seen to be mostly verbal and unessential; and science was under an obligation to show that an advantage accrued in the long run from such verbal innovation, and science neither recognized nor met the obligation, although there *is* an advantage, as indicated in footnote 100c). That turning of language topsy-turvy can be validly done (§51, etc.); but it is rather confusing. We shall see (§§91, 84, 93, etc.) how Reynolds in his scientific theory correctly called the Many real; he got "matter" as being holes in the ether, the holes traveling when "matter moved," and other weird verbal results, in an elaborately upside-down language. The Many, or an infinite pluralism, *is* real or true; but if we steadily verbally consider it so, we have to construct an upside-down language in which to state it.

h. There is one variety of person (other than the agnostic), unwarrantedly usually called a scientist, who is a pseudo-species of realist or pluralist that logically departs wholly from the truth. He is the *materialist*. He starts with what he considers an exact, sharp *This*, and he keeps on saying desperately $This_1$ $This_2$ $This_3$ $This_4$ $This_5$ but holds in effect that no One is achievable. Usually he does not explicitly assert that no One is ever synthesized; in practice he tends to be vociferous that there is no "PROOF" that we can ever sum up his "scientific" string of $This_{1\ 2\ 3\ 4\ 5\ 6\ etc.}$ into any meaning. He excitedly overlooks the fact (and it is an example of the principle that man can not make a real error) that his very vociferousness is a violent dogmatic assertion that $This_{1\ 2\ 3\ etc.}$ = *Null-Meaning*, which *logically* is precisely what he has been denying. —— However, in practice we shall take the materialist at his word, and say that in brief, instead of making an intelligent equation he makes a sort of formally disconnected single member of it, $This_{1\ 2\ 3\ etc.}$, and denies that there *is* any actual equation even while he is striving desperately to run down all the *This*'s:- $This_{6\ 7\ 8\ etc.}$ —and pile them up as mountains of statistics—an attempt to put salt on the tail of the universe, so to speak. Obviously, his acts and his implicit logic contradict the folly of his outward protestations—although he vociferates so much that it sounds noisy just to talk about him. He views his mountains of statistics, which he erroneously calls science, in despair, and emphatically denies that any complete grasp of knowledge,

such as we are seeing in this book is in actual fact fairly easy, is possible. He says this book is "impossible." In character, he is a pessimistic, talkative weakling.

i. The defect of the three ways of calling one or another member of the Trinity the important one—"reality" or the "truth"—is that those who undertake to do it are usually opposed by other schools with doctrines giving a different emphasis. Then the opponents get excited, increase their emphasis, and tend to finish with each school substantially asserting that its emphatic part is its *only* part, and that the opposing schools are wholly wrong. Such fanatics are very entertaining, even if distressing. History, including yesterday's newspaper, is full of their vagaries. When not ameliorated in some way, their excess tends to cumulate until it reaches the borderland of insanity as some form of megalomania, paranoia, or Nietzscheism. E. g., materialism is obviously the result of becoming so emphatic about the reality or "practical importance" of the Many that the other two parts are either wholly or practically denied.

j. The essential characteristic of those three ways of considering some one of the three parts of the Trinity the important one, and naming it "real," is that such emphasis is considered a *fixed* emphasis (i. e., it nominally does not change, and fall on some other part); so we may call such forms *static logic*. We can note that the average man (who is paying slight attention to "logic"—and that includes even professional theologians and mathematicians for the most part of their lives, and perhaps for the greater part of their professional writings) does not use any such static logic. The average man, whenever he uses *any* one of those three sorts of words, regards that word *at the time it is used* as pointing to or meaning the truth or reality. It is a *dynamic logic*:- the emphasis ("reality") is laid *on that particular sort of word which is at the moment being used*, and then changes or *moves* to the other kinds as they are used. And obviously, the emphasis is thus in principle distributed in *exactly* proper proportions. Consequently, that sort of logic is the strictly valid sort (and the same sort of principle of validity is extended to the end in footnote 100c). Hence, our general equation is valid in that sense; for we have not considered that one member or one symbol of it is any more "real" or important than another. And whatever word will name that sort of logic is an appropriate name. Those given above are not quite appropriate, as we may now see; they are usually somewhat quantitatively inaccurate for us.

k. But the reader can now see definitely (cf. §§25, 13) that our observation of things as they are, especially of language as it is, has showed us that all of the historical doctrines of the truth which have had any special vitality are qualitatively substantially right. All the great religions have been substantially right when considered apart from the theological perversions. All those valid doctrines were obviously conscious or "intellectual" attempts to state a unity already dimly perceived by people (§170j), and the inevitable result was an over-emphasis somewhere in them (§155). Poor emphasis does not make a statement "wrong" qualitatively; but it does make it quite liable to be misinterpreted (even by the author of it—which is why we may often properly assert that we do not think that some writer knew what he said or meant), as it is more or less *quantitatively* inaccurate. (And then science came along and attempted, usefully and properly, to correct such doctrines quantitatively by *measuring*. Some scientists in turn so violently emphasized their correction as to become materialists —thus making a religion, but one of the null sort.) —— So it is glaringly obvious that the simple solution of the riddle of the universe is that the man in the street uses valid logic, and there never was any riddle about it. There is nothing strange about the fact that the average man has always been qualitatively right (even if somewhat inarticulately so): as a rapid proof that he has been, we may note the truism that if that average man had not been right the race would have died out long ago. —— And cows and birds use valid logic so far as they need it for their environment—which is far enough to use One ejaculations. The overtalkative people—philosophers, scientists, priests, poets, and other varieties of persons who, being more or less biological sports and unbalanced (§159), write books—became verbally self-conscious and hence rattled, and manufactured "riddles" and "mysteries"—even for themselves—where there were none. But somebody had to do it thus more or less wrong, by that ultimate method of trial and error, in order to develop the highly useful and sure language tool we now have.

l. Consequently, as the valid logic is such a "commonplace" affair, there are a number of common and familiar names which conventionally apply to it. "*Valid*" is one; "*dynamic*" another. We have seen that ultimately all things join together as identical; and we have seen that the emphasis on the three parts of the Trinity is identical in valid logic; hence, we may call it the *logic of identity*. (Classic logic is obviously logic of non-identity, as each premise is nominally distinct and different.) And since our valid logic is used by the average man it may conventionally be called commonsense logic, or simply *commonsense*—or common logic, or everyday logic, or intelligible logic.

m. And the reader, finally, may like to know when and where this logic made its appearance in literature. Of course, as a truism, it has *implicitly* been used in all intelligible writings that came to correct conclusions which were stated with fairly balanced emphasis. *I* have not invented it. It is simply the "commonsense" that people so often mention. I am merely pointing it out and describing it. The prehistoric men who invented language invented it, apparently half-consciously and without formulating specifications. The whole universe acted on them to cause them to invent it—in ways we implicitly see in Part Three.

n. The valid logic has explicitly been used by a number of men in forms that were pretty definite. Christ was very obviously somewhat consciously using valid logic (§162e). So far as I can judge, his reported utterances in the Bible have been somewhat falsified (perhaps both unintentionally and intentionally); but they still show that Christ recognized valid logic and was deliberately using it. That was a stupendous feat in his day, and indicated his remarkable balance or great character (XVIII, §167b). Any fairly intelligent and honest person ought to be able to do it now.

o. For his age, Christ was reasonably definite in his use and indication of the valid logic. So far as I am aware, the next man to become more definite was Buckle, in his essay, "Mill on Liberty." Buckle attributed the ideas to Mill, but in my opinion Mill is largely innocent of them. The next person I know of is Dewey; his "Psychology," written over thirty years ago, was more definite than Buckle, and his later works are steadily more so. Dewey has often been "accused" by classic logicians of using circular logic, which was precisely what he was doing, and doing validly, and with rather good technique. Dewey, as far as I can judge, was the founder of the present and valid, school of psychology, named *behavoristic* psychology. That name obviously means dynamic—and such psychology is of course in general agreement with valid dynamic logic. I use that psychology in this book (XVII), rewriting it in simpler form and eliminating its overstock of technical names. And it

is shown repeatedly below, that all other valid knowledge, like valid psychology, is "dynamic."

p. James gave the name *pragmatism* to substantially the same logic—but bestowed the name before he worked out the technical details very well. There are technical defects in the expression of pragmatism—which do not, however, warrant explicit consideration in this condensed book. The leading American philosophers, headed by Dewey, have corrected the substantial ones; and some of those philosophers have repudiated the name *pragmatist* along with the repudiation of James's errors, and call themselves *neo-realists*. (So far as I can find, living philosophers outside America are scarcely out of the amateur class.) —— And David Starr Jordan independently, and before James and the neo-realists did so, worked out the valid logic in "The Stability of Truth." Alfred Sidgwick has, with somewhat less definiteness, the same valid logic in his book, "The Use of Words in Reasoning." Stallo rather definitely implied it in his "Theories and Concepts of Modern Physics," which was explicitly perhaps too destructive. And Karl Pearson, in "Grammar of Science," nearly thirty years ago explicitly and emphatically made for science the distinction between Many words and One words under the respective names *perceptions* and *conceptions*, and went so far as to deduce from that distinction the principle that mass varies with velocity: that "deduction," as Pearson showed, was simply a correct interpretation of Newton's laws (§88). Pearson's book is now scientifically accepted almost as commonplace; but it was novel when published, and I think was, in spite of its grave defect, one of the five or six first-class books on physical science of the last century. It contains a bad defect which has marred Pearson's later work:- it omits explicit naming and consideration of relationship words, and that perhaps technically comes close to making Pearson a materialist. What seems to have been the actual difficulty is that Pearson tends to be a mathematician; and as mathematicians write relationship words as symbols $+, =, \times$, different from ordinary words, therefore he more or less unconsciously took it for granted that no ordinary words were needed for or about relationships: so he omitted them. As a truistic consequence, his book was not intelligible to non-mathematicians (it is readily intelligible when the omission is supplied); also, the person trained in orthodox mathematics could more or less understand the book, but as he himself did not explicitly know the language trick with reference to the relationship symbols, he could not clearly express what he had understood. —— This paragraph of course simply states my judgments. There is no space to show the historical evidence for such quantitative matters, and my guesses will probably be disagreed with by some. And nearly surely there are other historical instances of fairly definite use of valid logic which have not come to my attention. There are not likely to be any very substantial uses of it which I have overlooked; for such use would have been by a person of such unusually strong character that he would not be the sort that is overlooked. For further remarks on the character of men who could use the valid logic, see §167b.

q. Probably it is safer never to use for very long any particular name for the valid way of expressing the truth. The way itself has an indefinite number of possible variations (§63, etc.). If we adopt a fairly fixed name for valid logic, some soft minded person might take it to refer to a fixed system—and thus be a word idolater. —— But there is the graver danger that the intellectual exploiters will promptly grab any definite name for it, and capitalize it for their benefit. The exploiting capitalization of the word "*Christianity*" is so pernicious and generally prevalent that many people are becoming doubtful whether they wish to be named Christians. *Democrat* will probably be the next word exploited on a large scale; the demagogs have already been watering the stock of that word generously, and as this book is likely to make it definitely no longer respectable to be an aristocrat, probably all the intellectual bunco men and their soft minded followers will scramble even more to steal the now better trademark *democrat*.

r. The common, *untechnical*, everyday name of the truth set forth by valid logic—other than *democracy*, which applies particularly to people—is *idealism*. Hopkins, in his Dartmouth inaugural address, names the common views of that truth (he expressing them implicitly in valid logic):- "*constructive idealism*." That name gives as much descriptive information as to what is truth as any I can think of. It is somewhat obviously a verbally self-contradictory name, meaning an idealism or unified One or religion, definitely expressed mechanically (so that it will be *applied*).

s. In the process of giving a large choice of names fairly suitable for the valid logic, so that the very number discourages exploitation of the name, I have tried to make clear the complete meaning of the valid logic, and to attach it so strongly to all the historical knowledge and well established emotions possessed by the reader that that essential part will be easily remembered. I of course would not have used the space discussing the choice of merely a name: one line would have sufficed for a name and nothing else. —— There has further appeared implicitly the answer to "What's in a name?" The answer is:- history—meaning mental connections or associations, or unification, and emotions, so that appropriate action readily results where there is much history—or "advertising"—and hence habit attached. So it obviously is an advantage to have a familiar, common name, even if the exploiters do capitalize it, stealing its trademark value. We have to balance—compromise—between having a name that automatically arouses emotion, and having one that is not so very automatic as to make it worth the exploiters' efforts to steal. But that answer to "What's in a name?" includes what the name *points to*; the *mere* name is a little ink, or sound.

t. We have now seen in a little intelligible detail that everyone with "commonsense" has previously understood the essentials of this book. For I am simply writing out the explicit details of what for centuries has been recognized as such commonsense. We have seen that the general argument of the book has been rather definitely stated numbers of times in the past. Hence, because such knowledge is so old, it is rather obvious in theory, even without observing the actual facts, that a normal five or six year old child can understand the book—and even more so that an intelligent adult can: that the adult is quite competent to grasp all essentials of the book. —— But there is another side to all that, which other aspect shows some important conclusions:- The reader may occasionally find himself struggling to grasp something which is written in the book; and so would naturally feel resentful if it were held that a six-year-old could understand what he himself finds so difficult. But those difficult details are the Many, and of course probably would not be grasped by the child—*and are not essential*. The essential parts are the One conclusions—the seeing that ultimately things are related, and work together. I am forced to state those Many details from *my* point of view; and all readers occupy *other* points of view, so that those details are more or less unfamiliar to them, and hence "hard." Of course the reader finds it hard at times to "grasp" things from *my* point of view. Also, as those details are in infinite regress, very shortly I find it extremely difficult for me

myself to grasp the series far out. The better the reader is as an observer and thinker (a "thinker" is an observer of the relationships of his "observations"), the more emphatically will he be conscious that he is not grasping all the Many details as *I* see them—is not getting the *detailed* significance of what I say. —— But, to repeat, those details are not essential; they are the Many and are ultimately arbitrary. The reader who is a good observer will substitute his own details for mine. If the circumstances were reversed, and the six-year-old were the writer and I the reader, the same principle would hold:- I would be forced to see (if I were a reasonably good observer) that the child expressed details that ran on to infinity, and that I couldn't "grasp" them or understand them as well as he did. Considered from that aspect (of details) the child would be "mystic" to me, and hence deserving of the highest wonder and awe from me. Or, speaking rigorously and more definitely, I could learn from the child. Yet at the same time I could readily grasp the One conclusions of the child, just as the child can grasp any of the essential conclusions of this book if I state them in words he knows (it is possible to do that for the average child). —— So obviously, all of that is proof of two important practical points:- (1) The definitely observable facts about so "abstract" a thing as "logic" or words show that other people are really deserving of our wonder and respect for their capacities and ultimate dignity (or even "divinity") and lovableness; or those facts show rigorously that we can learn from anyone, but need not be essentially troubled or "lowered" if somebody knows more details about a certain thing than we do—for in nearly every subject that state of affairs does exist. (2) Those facts further rigorously show the error of the frequently encountered erudite person who prides himself upon the possession of some special knowledge or intricately complex knowledge of some sort of details. Any "knowledge" which is so complex that it can't be explained to a child well enough for him to get the essential meaning of it, is either unfinished and in that degree unintelligible to its erudite possessor, or else is wrong in some degree and not knowledge—simply isn't so. When such knowledge is also concealed from the average person, as in "secret diplomacy," it has the same defective character, and in addition the concealment is undemocratic and immoral (§§167-9), and its possessors deserving of contempt and scorn—instead of envy and an idle curiosity, as was the case in the crude and aristocratic childhood of the race. —— We shall from time to time see more familiar proof and expression of this paragraph. I have here simply given the general outline from both the One point of view and the Many point of view, of what the reader can "understand," or has need to; and of what that implies.

CHAPTER VII. *Statement and proof of valid logic from additional points of view.*

§50. a. In this section valid logic is briefly but rigorously demonstrated by using the principle of incommensurability (or commensurability). Two "quantities" or "numbers" or units of the Many, or two things, are said to be commensurable when there is some third quantity of the same kind (another thing), called the common measure, which is exactly contained a definite or whole number of times in each. Two quantities are orthodoxly said to be incommensurable when they have no common measure. E. g., the diameter of a circle is incommensurable with the circumference; i. e., if the diameter is 1 unit long, the circumference is 3.1415... units long—meaning that *no* number will *exactly* express the circumference. (Obviously, that orthodox definition agrees with the argument of this book, and does not consider 0 and ∞ "numbers.") The "number" 3.1415... or π is said to be an incommensurable number—meaning that it is not actually a number, as it ultimately can not be positively expressed.

b. I shall make some digressive comment in this paragraph, anticipating the conclusion we are to derive, but anticipating it in a not very intelligible form. —— If the diameter of a circle is a line having a *definite* length, then it can be conceived, or considered to "exist" (i. e., to assert that there *is* a diameter is not a self-contradiction $A=A$ and A *is not*$=A$; specifically, is not *Line=Definite length or Line*, and *Line is not=Definite length or Line*), and its representation can be "drawn" as a "line" on paper. Therefore, *if* there is a diameter, *then* it is glaringly obvious that there is *not* any such thing as a circle or circumference according to orthodox mathematics—for the circumference is *not* definite and hence not a line—or can't exist as anything. A circle is thus *conventionally* inconceivable, for if we have a circle it can not have a diameter, and vice versa. Similarly, by orthodox mathematics it is absolutely inconceivable that a square have a diagonal, an equilateral triangle an altitude, etc. Orthodox mathematics itself asserts in effect that it is irrational—i. e., nonsensical—to say that a circle may exist, when it says π is irrational. Hence, by following the same argument we demolish all orthodox geometry and related mathematical doctrines. In brief, classic logic, as used in geometry, definitely gives nonsense. —— The immediate conclusion from that reductio ad absurdum (it is somewhat difficult to see clearly to the conclusion here, as the reductio is naturally negative in form), is that there is no exact science. If we do start with the absurd assumption that a line is ever in any Many sense something absolutely exact, then we get into those orthodox difficulties:- briefly summed, that there is no geometry possible. Or, more remotely, we see that the Many members of our equation, *That*...$\times$ *This*..., and M(*varying with*)L^2T^{-2}, necessarily assert the infinite regress even in geometry. And it can also be seen further that a consistent geometry is *dependent* upon the explicit solution of the One and Many, and that another way of viewing the orthodox difficulty above is to note that "*line*" (and similarly *point*, *surface*, *solid*, etc.) is a name containing considerable relationship meaning—is often practically a relationship noun, or is "abstract"'—which must in any valid logic be distinguished from Many words. To separate out such relationship terms is equivalent to rewriting geometry and its allied subjects, and the several volumes of that is omitted from this book at this point. Orthodox geometry is *substantially* valid; it is merely vague and inaccurate and verbally inconsistent (cf. §§60-3). The reader need not feel that I have destroyed anything substantial; but in just one paragraph he has seen that he is warranted in being somewhat unimpressed when a mathematician thus rhapsodizes:- "Coterminous with space and coeval with time is the kingdom of mathematics; within this range her dominion is supreme; otherwise than according to her order nothing can exist." So-called hard-headed scientists used to listen to that sort of thing soberly. Now it is more kindly to omit the name of the man I just quoted, as he is still alive.

c. We may generalize the fact that the diameter is incommensurable with the circumference into this proposition:- any perimeter is incommensurable with its average diameter. I have not been able to find any published proof of that proposition. It is obviously to me true, simply as a truism involving the solution of the One and Many. If it is not thus obviously true to the reader, or obviously true as being

a perfect analogy (§94g) to the conventional special case of the circle, then this whole book furnishes the proof, and the further proposition which I show in this section works backwards to establish the foregoing general proposition.

d. It therefore follows as a truism, that *if* there were any fixed or exact or *constant* parts of the universe, it would be absolutely impossible for them to join with the other parts and form a body or a universe that had a perimeter. And that truism holds vice versa:- that if there is any real, connected, mutually-working-together universe, then it is absolutely impossible that it should be composed of exact, definite, constant parts *of any given finite* size or sizes (for such would give impossible definitely-measurable diameters).

e. That last paragraph is the verbal expression of validly rigorous mathematical proof of the truth of this whole book or argument, with respect to its *general* consistency. Or explicitly, it is rigorous proof of the consistency or formal truth of our general equation, and hence a proof of the erroneousness of all equatious of whatever sort which fail to conform in principle with that general one. And that proof is perfectly reversible; i. e., it itself works vice versa as was seen; also, if the proposition in par. c is accepted, par. d proves the book; and if not now accepted, the book proves the proposition. And obviously, that is a general example of the principle that valid logic is circular; a formal proof of that principle is this:- all *expression* of proof if valid is reducible to the truism $A=A$, and it is immaterial which A of the two A's comes first, as formally or logically they are identical (§§35, 58j). Hence, if there is any "rule" that will not work both ways, the "rule" is not a rule or principle that is subject to *any* proof, but is simply a quantitative guess, subject only to temporary inexact verification by measurement. Therefore, obviously, as a general principle, *no* quantitative fact—no proposition which includes in itself any *particular* time and space (as contrasted with our *general* L and T, that are relationship words that may be applied to *any* particular units of the Many)—is susceptible to any such thing as *expression* of proof; it is subject *only* to direct observation, or what I called "real" proof (§35). Or, we can put it at once into scientific terms:- no so-called cyclic process, short of a cycle including the total universe (in which L and T are *not* particular measures) is perfectly reversible (Index, "Cycle"). Or, more specifically, *no* machine which exists or can be made, short of the total universe, is perfectly reversible. I. e., any well-designed machine will (1) perform pretty *nearly* the same operation or cycle after making one "revolution" (such as the earth's rotating daily in *nearly* the same time); and may (2) run *backwards* in revolutions or cycles that more or less approximate the cycles in the ahead direction (in some ordinary machines the approximation is so remote that we briefly say that they "won't" run backwards, in the same way we say the Kaiser was wrong; §25). But in no case, short of the total universe, will that *repetition* of a "cycle" ever be an *exact* repetition (and ingeneral, *repetition* includes *reversal*; see Index, "Direction"). Part Two proves that general principle in useful detail.

f. We could go on from that point of view and consistently completely describe the universe. The orthodox point of view of the science called *heat* would be the next step. Or we could at once shift that principle of cycles to ethics and show that a workable or moral life was *ultimately* or as a One a perfectly balanced cycle (i. e., reversible cycle, in which the "other fellow" had a fair deal or reaction) of various acts, which cyclic balance is commonly named *temperance*. In a really unified knowledge, obviously, as a truism, we can start from any point of view and consistently describe the universe; I mention those two large extensions of the present point of view as an example of that principle. The practical need of having an end to this particular book obviously precludes my ever going on to all the implied details —of ever continuing explicitly to name the dots of *That*...× *This*...—or even of pointing out that possibility often.

g. In this paragraph I summarize the general proof of the argument of the book, by the use of incommensurables. It is so brief as to be hard to follow. —— The fact that Many units can not be bounded by a definite or exactly commensurate perimeter or One obviously shows that the One and the Many are absolutely irreconcilable in their formal contradictoriness. If we say that there is *really* and truly a One, then it is, *by our everyday language agreements*, formally or logically impossible to say that there is simultaneously a real Many. And we can see at once that in general there are two immediately applicable ways of reconciling that contradiction:- (1) We can say that the Many is absolutely infinite, and as such is absolutely true at the same time that the One is absolutely true (*but* that changes our everyday language agreements, as we shall see). That is what we do say, in our valid logic, in the *formal* way of reconciling the contradiction (i. e., we formally say $L^{\infty}T^{-\infty}$). For then obviously we can, in the absolutely infinitely small units of that infinite Many, which are really absolute zero, find a common measure that *will* serve as a complete measure for the otherwise incommensurable One. Logically, that way is consistent, and gives us our zero-infinity logical rule. But our everyday language is constructed on a formal implication that the One is "real," and that the "infinite Many" is not "real," and hence is a verbal contradiction (cf. footnote 100c). By such verbal agreements, *infinite* "really" means continuous, and *not* a "measure." (2) But we can use that *formal* reconcilement, and at the same time use the *practical* reconcilement of stating and showing that there is no exact science—that we can not be exact or accurate about the Many,—that when we do make a "real" or definite perimeter or One, then the Many or that perimeter's diameter actually is *not* exactly commensurate in any *measure* that we are *verbally* able to set down in full. In short, we drop the $L^{\infty}T^{-\infty}$ and use L^2T^{-2}, and say that practically there is an infinite regress, which we formally merely *imply* by writing π as 3.1415..., or as *This*.... And that practical way of handling the difficulty clearly agrees with the obvious fact that we can and do conceive geometrical circles, and have no difficulty in representing them approximately.

h. That rigorous and concise proof of the argument is so brief that it is scarcely susceptible of being more than superficially comprehended at first. Probably a million corollaries—implications—could be dug out of it with but casual vision. Hence, in theory, and also according to my actual experience in using it on some of the ablest thinkers, it slightly dazes the reader at first. You can use it to gauge your own mental capacity:- If on first reading it you get a vague glimmer of what I am talking about, your mental power is as great as anybody's in the matter of soundness, integrity, or keenness (although that will not perceptibly be a measure of the *endurance* of that strength—the ability to *keep on* using such a strong mind until you *get*, and not merely aspire to, whatever you are after). If you want to compare your mental strength with mine, you are informed that I had to dig at that proposition for about two years before I got what might honestly be called a definite glimmer —you probably have a keener mind than mine, but I have considerable endurance. —— Incidentally, if anybody is fond of brevity, and thinks that anything which is true can be said very briefly, then here, in 29 words, is not only a statement of this whole book, but also a rigorous proof of the

truth of it and of a unification of all knowledge:- Any perimeter is incommensurable with its average diameter. Hence, if there are exact *finite* parts it is impossible for that Many to combine into a One; and vice versa. —— With further reference to brevity, the title of the book, UNIVERSE, is a condensation of the book into one word. The defect of brevity is that it is not positive and intelligible. When we say "Brevity is the soul of wit," it is really meant that the *essential* of language is given by *Meaning*—that brevity, in the ultimate, is the One word; and that it, like humor, gives us a mild rebirth (§§162a, 34b)—that the equation is, *Humor...=Brevity, or Wit, or the One.* In that One sense obviously brevity positively expresses nothing, but is religion. We must have a temperate amount of *That...×This...* (of details) before we can expect to be understood.

---

§51. a. I shall now briefly summarize and prove all the theory of language, using a somewhat different point of view that gives some additional fine points, and also shows that language itself is so flexible or changing or incapable of being put into any absolutely rigid form or logic that it is practically imperative that each person who is going to understand and use a valid logic achieve that understanding and skill by experience of his own—getting in the end *a valid logic* (a *style*) which although thus valid *is formally a little different from that used by any other person.* Even the expression of the most rigorous mathematics can not validly be put into an absolutely fixed mould or form: *always judgment is needed.* —— Hence, we need to look at some of the fine points of language; and truistically the argument must become complicated, and will for that reason require attention if it is to be understood. This section is very hard reading. If the reader is not an expert at mathematics, science, or logic, or desirous of being one, he can perhaps most satisfactorily and usefully to himself merely scan the pages of it, taking only what strikes his interest.

b. We made an agreement as to what words do, and the formal agreement that we shall not say $A=A$ and simultaneously *A is not*$=A$. We then observed, as a formal basis of all language—or language mechanics,—that there are three more or less distinct forms of words, which are analogous to the three parts of the Trinity. The fundamental truism concerning those three forms omits the use of one form (the One), and is this:- if we are going to talk about parts of the whole (as we tacitly agree to do when we use language of any sort), then we must have (*1*) the names of those parts (God the Sons), which *must*, as the truism, then be joined into the whole [which One need not be explicitly named] by (*2*) symbols or names which do join them together (relationship words, or God the Holy Ghost). So far as logical necessities of language go, we could verbally stop there, with just those two forms of words—(*1*) and (*2*),—and *understand* the unified meaning, but not SAY *Meaning.* And we could consider that formally there were *two* reacting parts (i. e., the Many words with the relationship words)—a *verbal* dualism fundamental to all speech that is positive, all doctrines, all machines. —— The reader may note that I have shifted view point, and instead of taking a concrete view of the actual Many, with *its* parts reacting among themselves, I am looking at language directly, and considering what I call the reaction on each other of its two sorts of words that have been mentioned. I therefore truistically consider that there is a *verbal* dualism (*1*)×(*2*), in place of the *That...×This...* heretofore expressed (for explicit consideration of that new form, see footnote h). That shift of point of view of itself shows how very flexible our language is, and how, if we formally omit some part, other words will imply it (I have omitted mentioning any but one formal unit of the Many:- naming only (*1*)).

c. So we have (*2*) verbally reacting with (*1*). But, to obtain the previously mentioned convenience in jogging our memories and attention (and probably as a vestige of primeval language, in which there existed only One words, while and before men were inventing the other parts of the language machine), we all actually do go on to a tautological process, and deliberately repeat what the primary necessity in formal speech would and does do of itself; i. e., we use (*3*) words or symbols which *again* assert—which now explicitly *name*—the whole or One which the other two forms have already *said* or positively expressed,—these third, tautological words being God the Father. It is that pure tautology of (in a way) deliberately saying *twice* everything we have to say, that has been the final "mystery" that for ages puzzled the seers. We knew so well what that mystery was that we exuberantly said it twice—which was most illogical by the classical logic, which frowns so on exuberance that it has almost killed our quite proper and correct commonsense instinct to use two or a dozen negatives when we are sure we mean *no*, and has produced the monstrosity, "May I not?"

d. We may summarize what we have:- The form (*1*) is parts of the verbally-split universe; the form (*2*) joins those verbal splittings together again into the whole; the form (*3*) tautologically names and thus repeats the whole. Or, (*1*) used in connection with (*2*) *is* the whole or meaning, and is also tautologically *verbally* equivalent to (*3*). We may write that (*1*)×(*2*)=(*3*).

e. Obviously, (*1*) and (*3*) are logically or *formally* self-contradictory. Also, (*1*) asserts a splitting, and (*2*) asserts a rejoining, and those two ideas are in *reality* or meaning absolutely self-contradictory; or (*1*) *and* (*2*) *produce* or assert nullity or *zero* in the sense that the things asserted by (*1*) are not *really* split off or separated. —— Again it can be noted that I am taking a different point of view, by explicitly considering as a form itself the *contradiction* introduced by (*3*), and considering contradictions in both *form* and *meaning.* As a matter of fact, we have started on an *infinite regress of logic itself* (see par. h). It should also be definitely noted that when I said 'the things asserted by (*1*) are not *really* split off or separated,' we are using *real* merely as a tacit verbal agreement:- for we could just as well have said that the One (*3*) was not *really* connected. And it can again (see §49g, etc.) be seen directly that by thus reversing the agreement we produce no real changes in the conclusions which we are going to derive, but merely reverse language or the dictionary.

f. It is also obvious that (*1*) and (*2*) are *formally* totally different or contradictory, being the two sorts of words which are formally needed together to make an *explicit* or positively expressed whole. Hence, when we use them together, as (*1*)×(*2*), we have the fundamental lingual requirement of the truism in par. b:- that we split the universe and then join it. So that formal contradiction must inhere to make the logic valid, as it balances and cancels the formal contradiction we started with. That finishes, from the present point of view, with *formal* agreements (but see par. h for extension of the point of view).

g. We then have the disagreements in meanings—(*1*)×(*2*) being made up of parts, and (*3*) being really a whole. But (*1*)×(*2*) is only *formally* made up of parts, because the explicit *meaning* contradiction inheres only in (*1*), and is removed or really contradicted by the (*2*). Consequently, though there is a contradiction in meaning of the words we use, the contradiction is destroyed as stated, and is not real in language *as a whole.* Consequently, the whole equation

(*1*)×(*2*)=(*3*) is absolutely true, and must contain the double contradiction—one of form and one of meaning. That double contradiction also justifies, or formally necessitates, from this point of view, the existing tautology.

h. *But*, language *as a whole* thus being without *any* actual self-contradiction, it follows at once that we have now really failed to use our requisite mechanical truism that was started with in par. b:- that language must have reacting or contradictory parts.[51h] Hence, we start all over again with our equation, and consider the total single symbol '(*1*)×(*2*)=(*3*)' as being a *standard* whole that is now a Many, or a *new* (*1*), which we may write ((*1*)); and then we construct a *new* (*2*) and *new* (*3*), and put them together into an equation in order to get a positive assertion that is not ineffable. In short, we now have to begin to duplicate 'language' or 'logic' itself, in order to get the intelligible expression or equation that applies the truism. And obviously, it is an infinite regress. When we do it infinitely (use up *all* time and space—or, do what is practical, take time and space as unreal), we achieve a *logical* and also a *verbally complete* language, or an *exact* language. —— I know it sounds queer, and is hard to understand. Well; there are always some men with minutely seeing minds (who as a compensating characteristic usually fail to see wholes or commonsense very well). They would find considerable fault with our original general equation as first derived, because the equation was substantially said to be finished or absolute. To say that, is equivalent to our conclusion in par. g, that the form of equation there was absolutely true. It *is* true; but *only* when it is seen that the infinite regress stated in this paragraph is also *implicitly* contained in it, and considered formally completed in it. But the men who have trouble in seeing a whole—usually the materialists—demand the details. So I have explicated the infinite regress for them. They can now follow it out in detail as far as they care to go (keep on drawing in the actual smaller and smaller picture of the advertisement), and keep on until they are by actual experience convinced that it will give an absolute whole. Obviously, they can not honestly assert that it does *not* give a whole until they have actually kept on infinitely on the regress, if it does not sooner convince them that they *have* seen a whole. So if they *can't* see, they are rigorously tied up to an experimental occupation that will keep them occupied and quiet forevermore, or allow them only obviously inconsistent talk.

§52. a. The last section, in making the flexibility of language obvious, implied some definite facts which are set down in this section somewhat at random.

b. We have seen more vividly that the same word may be used in each of the three forms. Often, many meanings that have been attached to some given word in the past may be now nearly dead, but still slightly remain as implications —or implication-ghosts, so to speak. Words, like science, can't be accurate or exact, and it is now quite obvious that our formal separation of words into classes is itself just a convenient, arbitrary form which is inexact, and is subject, like all Many things, to infinite regress.

c. We thus again see that we can not validly make any *sharp separations* in the universe—not even of words into classes, although words are obviously as arbitrary as anything. —— And that fact will often serve as a useful measure of the ability of men. If we observe a man insisting on "sharp distinctions" between *any* classes of actual things, or insisting that *his* way of making classes (of judging any Many proposition—or that in human affairs he knows just how to separate the sheep and the goats) is essentially right, we may at once safely decide that he is more or less incompetent, and knows little of his subject. In this day, that test is perhaps the most easily applied test of mental competence. But of course the incompetent who is cocksure about quantitative problems will quickly discover what yardstick we are using on him, and superficially avoid being so obviously foolish.

d. Or we may express it, that a word used in a context has "fields" or implication-auras that stretch out and bind the word continuously in meaning to the context, even if the word does appear superficially to be "printed separate." Hence, words in use have the characteristic of other Many things; just as there is no sharp *This*, but always *This...*, so no word is sharply *Word*, but always *Word...*. Modern physical theories have atoms with such "fields" (§89, XI).

e. And we may observe that words are perhaps the most highly specialized tool, or machine, or means of transmitting force, that we have—meaning that it is *possible* to *control* the extensiveness and intensity of the force, and hence *its results*, more completely when we use the language machine than when we use any other machine (e. g., than when we use the skeletal levers and muscles behind a fist; or apply them to shoot a gun). Words actually "exert force," just as explicitly and definitely as do molar bodies—as do machine guns, a heaved brick, or an engine. The words printed here (even if primarily considered as only so much ink) consist of very energetic atoms that "forcibly" make very perceptible changes in your eyes and nervous system. Considered more indirectly as directing your attention to certain things (and that is also what a 16-inch gun is "for"), they act as a trigger—a slight starting or initiating force—that may result in enormous force transmittal. The advantage of words is that they can be devised to transmit very accurately the kind and quantity of force (the modern technical word of course is *energy*, but we may here continue to use the ambiguous but more forcible popular "force"), which it is desired to transmit in order to effect a given purpose. Truistically, the effectiveness of words depends, like that of all other tools, upon the skill and strength and endurance of the user (actually upon his whole personality; cf. §140e), *and also* upon the personality of the receiver. Everybody except infants and marked defectives uses words—and the infant really uses the primitive words (One ejaculations, or cries), and makes up by emphasis some of what his words lack in positiveness. The business man carries on much of his business with words—often all of it, in a direct sense. Bullets and clubs are obviously very crude tools for the exercise of force, as they are under very poor control and give very uncertain results. The truth of that is rather well recognized, as is proved by the fact that people who wish to seem intelligent or even barely civilized invariably try to show that the other side started the use of "brute" force—i. e., poorly directed force. Of course, if militaristic persons

[51h]The reason I succeeded in making an *intelligible* or positively expressed equation, instead of winding up with an equation or language which, as just asserted, was without reacting parts or 'contradictions,' and which hence was ineffable and unintelligible, is this:- without saying anything definitely about it in par. b and d (where it would have been confusing), I introduced into the equation the relationship symbols × and =, which was equivalent to *implicitly reduplicating* the three forms in infinite regress, or to implicit assertion of this footnote. A simple description of that *literally* infinitely involved statement is this:- in an advertisement which contains a picture of a man holding a periodical on which pictured-periodical again appears the same advertisement, it is obvious that to be *consistent* the second picture must contain another picture of the man holding the periodical on which again appears in still smaller picture the same advertisement, and so on ad infinitum. That equation (*1*)×(*2*)=(*3*) was the original 'advertisement,' and it, so far as I *at first explicitly stated* ought to have been (*1*) (*2*) (*3*)—an ineffable, unintelligible language *without contradiction*, etc. —— See the text for the further unwinding of that infinite involution.

of such inferior mentality start using "brute" force they thereby definitely indicate that they are incapable of very well understanding or using more efficient forces, and intelligent people have to give them a sufficient dose of the sort of force they do understand (§114c). A person who is militaristic in "private" life—in affairs between individuals rather than between societies and governments—is conventionally called a blackguard or bully. Militarism is merely wholesale blackguardism or bullying—and still exists simply because it is a little harder to see the nature of a reaction between many scattered people than it is to see the nature of the same reaction between a few close together "private" people, so that some persons of a low grade of intelligence fail to see its blackguard character.

f. But ultimately words are a tool—a means;—fundamentally a relationship, just as "force" is ultimately a relationship (§88, etc.). Because they are so useful, we are prone to mistake words for the actualities to which they point us or join us. That is word idolatry—a mistaking of formulas, "systems," creeds, dogmas, books, for the One, which is as silly as bowing down to and being afraid of a golden calf as such—and a good deal more prevalent.

g. And finally, we may note that if we begin to state our observations of words in detail, we have the collection of conclusions that is called rhetoric. I give a minor example:- Adjectives and adverbs are observably not very definitely any one of the three kinds of words; they are rather vaguely Many words which supply some of the dots after *This....* Hence, because of that vagueness, when they are used they subtract from the forcefulness or clear simplicity of what is meant. Therefore, where force and rough-clarity is desired adjectives and adverbs should be at a minimum. But where explicitness and considerable accuracy is desirable—where we have to be definite about some of the dots: display a keener judgment,—adjectives and adverbs (and parenthetical phrases somewhat equivalent) have to be used to some extent.

h. Rhetoric is commonly called an art, or an empirical science—meaning that no definite relationships or unity between the observed facts of it was easily perceptible. We now see that the statement of the details of a valid logic becomes a connected, rational science that includes rhetoric. Hence, the argument unifies logic and rhetoric; and the facts of rhetoric serve as observations that verify the foregoing description of logic. A definitely scientific treatise on rhetoric is omitted at this point. —— It is a historical fact that centuries ago the name for general or unified knowledge was *rhetoric* or *grammar*. Apparently, men rather consciously recognized then that in the mechanics of language lay the solution of their puzzles. But the rhetoricians failed to clarify the puzzles, started exploiting and became idolaters of words, and fell into such disrepute that conventional "rhetoric" is still tainted with it, and their more honest successors were known by a new name:- philosophers.

CHAPTER VIII. *Mechanical model of language.*

§53. a. In this chapter is discussed a mechanical model of the forms of language. This model is a so-called *single surface ring*, including its infinitely numerous variations from what we may consider its regular form. This model is capable of being directly used as the model, or mechanical representation, of everything (§63i, Part Two). In this chapter we confine ourselves to such few simple facts as are needed to give a brief but rigorous description of the different possible sorts of language and-or space (*and* time; cf. §150).

b. I am unable to find any full mathematical treatment of our single surface ring, although I remember seeing a statement that there was such a treatment. I have not gone very far into the investigation of the figure—just far enough to see the possibilities of unlimited application of the model, which has been a geometrical curiosity for years, and is not mentioned in the usual text, or "Encyclopaedia Brittanica." A good popular description of single surface rings is given by Hering in "Scientific American," Feb. 21, 1914. He also gives a preliminary mathematical investigation of those rings and some additional interesting facts in another article ("Sc. Am. Supplement," Dec. 21, 1918, reprinted from "Jour. Franklin Inst.," Aug., Nov., 1918).

§54. a. The best way to comprehend this single surface model is to make a rough one—which can be done in a minute. It is such a surprising figure on first acquaintance that only the actual model is likely to be easily intelligible. Take a strip of paper (say) nearly a foot long and about an inch wide. Lay flat. The strip has two surfaces (neglecting now its thickness, and the consequent very narrow surfaces of the two side edges and two end edges), which we may term surface A and surface B. Hold one end of the strip flat, and lift the other end and turn it—twist it—over (around 180°), so that surface A is up at one end and B up at the other, with the strip twisted a half turn, as shown roughly in Fig. 54a. Then, without further twisting the ends relatively to each other, bring the two ends together to form a ring, and fasten the ends together (preferably with glue; or with a pin). It is then a rough single surface ring (unsymmetrical or warped in some respects, as we shall see). A picture of a symmetrical ring (with appreciable thickness) is shown in Fig. 63c.

Fig. 54a.

b. If you place a finger on any part of the surface, and move it all around the surface, touching the surface, it will then be on the surface that was originally opposed to the surface you started on, although your finger never left the continuous surface. I. e., if you started on surface A, after your finger moves all around the ring it will be on surface B, which is now a surface *continuous* with A, and not structurally opposite. The reason for that is of course that the 180° twist gradually turns the finger onto the "other side," and the twist also permits the surfaces to be continuous when fastened into a ring and the thickness neglected.

c. We may note some preliminary properties:- If with a knife or scissors the ring be split in two in the direction of its length (i. e., the original strip, *if* it had been flat, as in Fig. 54c, and not in a ring, would be cut along the dotted line), then there results a *single* ring; but this new ring has a 360° twist in it (a double twist), and has two surfaces, and has twice the length around. Then, if that ring be similarly split, two rings result, interlinked or beknotted with each other, and each with the same double twist and length around as the double-twisted ring. All subsequent splittings result in adding one more interlinked ring of the same length and the same double twist. But, if the single surface ring has an *edge* cut off (not 'splitting' the ring so that the ends of the dotted line in Fig. 54c would come together if the strip had been in a ring), and we keep on cutting around (twice) until we come to the place we started from, a narrower single surface ring than the original is left, interlinked with a double surface ring of twice the length, which is the edge that is cut off.

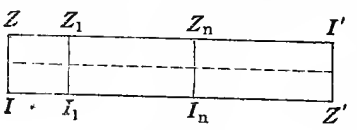


Fig. 54c.

d. Let us now tentatively agree that a single surface ring is a symbol of language, and hence a symbol of the universe. Or, we may call a symbol a *model.* Let us agree that one surface of the original strip, say surface A, represents the One; and that surface B represents the Many. And let us consider that the thickness of the ring is negligible (for the time being), and that the ring joins together at or in or as a geometrical line, instead of our having to lap the ends over each other in order to glue or pin them conveniently. I. e., let one end of the original untwisted strip as shown in Fig. 54c be ZI, and the other end I′Z′; then, when we make the ring, Z joins to Z′, and I to I′, and we have the single line ZI for a joint—it coinciding with Z′I′. Finally, let us agree that the 180° twist represents relationship. It then at once follows as truistic that neither surface *is*, or "defines," the ring, nor is the 180° twist the ring. But the three together—Many surface, One surface, relationship twist—completely define or express the ring.

e. In this paragraph I digress slightly from the direct argument and show the nature of the infinite regress, and also of a "symbol." I said that the three parts completely define or express the ring. Yet the three together are obviously not *really* the ring. The ring itself is the actual thing *between* the surface A and surface B, which thing *is twisted* and is not the *twist*, and which we are taking now to be of negligible thickness. We might say that the ring is *what* or *that which* is between the two defined surfaces: the *geometrical surfaces* are merely the *limits* of the ring, and 'describe' or de-fine it. In the same way, the universe is *what* is described by our words. But if we are asked to state verbally *what* that 'what' is, then all we can do is to begin to divide the ring up and define it as the collection of parts which are then given by surfaces which are closer and closer to coinciding, and to being pure geometrical surfaces of *zero* thickness. But *zero* thickness is not positive language, as we agreed before; it is mysticism (also, that attempt to say 'what,' may be observed to be truistically circular language or logic). Hence, we can not, with *positive* language in our *finite* lives, go absolutely to zero language and name all the zero parts of the ring. We keep going closer and closer, in infinite regress, towards that zero thickness, or *really* exact quantitative intelligible *meaning.* And the *symbols* are those Many steps, which use time and space. And obviously, although all attempts to use *language* will clearly be of that eternally formally self-contradictory nature (as a truism; because the language formally and finitely is *not* the thing it describes), the use of our concrete model gives us at once the conclusion that we *know* what we mean, even with that verbal regress which we can not actually finish. We *know* about the ring by looking at it, *observing* it: we *experience* its 'existence' (cf. §22); or *really prove* it (cf. §35) by seeing it. In a *few* words here I describe the ring—symbolize it, or point to it *intelligibly*, and you *know* the ring—and I do that without giving the infinite words of the regress. Instead of using an "infinite number" of words I have actually used about 800—and you not only "know" the ring in general, but you have already seen a number of related things.

§55. a. When we take the surface B of the ring as representing the Many, then we have arbitrarily agreed that we shall divide it into parts, or the Many, and that each part may be given a name—and must have a definite and positive name when referred to. We may agree that instead of naming the parts as various *This*'s and *That*'s, we can give them the general sort of naming called numbering. Suppose we divide surface B into parts by lines across it, parallel to ZI (Fig. 54c). Then obviously each *number* may be, conventionally, one of two things:- (1) it may be the name of one of those lines; or (2) it may be the name of the *part* of surface B *between* one really geometrical or zero line and the next.

b. Usually, the mathematicians and logicians seem to mean that a number (and by implication, *any* name—but they probably would not acknowledge the implication) refers simply to one of those zero *dividing* lines—to a *dividing* (which is actually zero; and "abstract"), and not to *what* is considered divided). In that case it is obvious that regardless of how many *actual* or positive numbers we used in naming all the parts of the Many (of B), always there would be the spaces left between those imaginary geometrical or ineffable zero lines or numbers, which spaces were the actual things to be indicated. In short, by that rather conventional practice, we have to name or number to a *real* infinity in order to get that surface B *actually verbally* named; and a real infinity here obviously contradicts the nature of that conventional numbering or Many—for real infinity means continuous. Also, it is further obvious that this more conventional way of naming or numbering the Many results in what is *practically* an infinite regress (see §58d for the details, etc.).

c. If we take the second view—that the name or number refers to the space between one line and the next (e. g., that 2 means the part of B between say Z_1I_1 and Z_2I_2),—it is again obvious that there is nothing whatever which *determines* or fixes how long (*how much*) that space is, or should be; nor how long the surface B (i. e., the whole of the Many) *is*. I. e., if the model ring is the universe, there is positively nothing outside it, which serves as a standard or as a measure to determine the length of surface B (or its width, provided we divided B in other ways than by those parallel lines). Consequently, it is glaringly obvious that there is absolutely nothing which determines fundamentally what—how much—a unit of the Many is. We take such a unit arbitrarily, making it convenient. Also, it is equally obviously a truism that there is absolutely no way of verbally stating *positively* how much the universe is—of giving it positive "boundaries" (we see the nature of its "boundaries" in Part Two; Index, "Difference surface"). For time and space obviously do not apply to the whole universe or to the whole model of it. Time and space are simply the *arbitrary* conventions we use in dividing up the surface B:- for obviously, we *determined* Z_1I_1, $Z_2I_2 \ldots Z_nI_n \ldots$, by saying 'the space or length between,' and tacitly took it that we required time to go over the space (or to take the parts in a one by one order, if we look at it that way). It therefore again follows by this second point of view that we may name a part of the ring anything we please (call it *any measure*); and that there is an infinite regress of naming. There can be no exact science for the simple reason that ultimately there is nothing which serves as a fixed standard or "center" by which we may judge any exactness. As soon as we have this concrete model before our eyes it is fairly easy to *see* directly that those things are true.

§56. a. When we take the surface A as the One—as God the Father, or *monistically*,—it is obvious that we consider it undivided, or as being a whole, and thus take it into our perceptions or consciousness at once—at one time. It is *one* surface; a child can conceive or perceive that—he *does*, in fact, and does it before he is able to divide it into the Many, as we saw when observing a child count (§26).

b. This One surface as a model of the universe or One is characterized chiefly by its simplicity (i. e., familiarity), obviousness, and total lack of definiteness, 'positiveness,' and *properties.* It simply is continuous, or One, or the whole.

c. Possibly the most important point of view to be taken of the observable fact that the One surface as a model has

absolutely no properties in any positive or definite sense, is that the One is not determined or bounded in any way. That is obviously a truism, and it clearly implies that time and space does-do not apply to the One. There are no *parts* of the One, considered apart (spacially "separated") from the other parts, and hence comparable with them, the *comparison being fundamentally* a "*property.*"

§57. a. Relationship words are represented by the 180° twist. Obviously it is the existence of such a continuous twist that maintains the ring as a continuous surface. We have seen (§28h) that the chief characteristic of relationship is that all relationship is that of identity. That may be clearly seen from our model:- Suppose we hang the ring over (say) the left forefinger held horizontally, placing the left thumb on the 'upper' surface of the ring; and then pull the ring so that it slips around between the finger and thumb. 'Both' surfaces finally rub on the thumb, without the thumb's changing its space location: the 180° twist or relationship simply travels in the down-hanging part of the ring. The thumb obviously always bears *identically* the same relationship to the total form of the ring, although it rubs all of it in turn. (I. e., it does, assuming that the ring represents the universe with nothing outside, which is the same as assuming that the actual model ring is perfectly homogeneous and flexible and acted upon by steady forces, thus making it always hang in a constant loop—none of which is true of the actual paper ring.)

b. It is to be emphasized that the last paragraph tacitly assumed that the ring was "symmetrical"—which means ultimately that space and time, as used to name its Many aspect was unchanging (or agreed with the "space" of ordinary geometry, called Euclidian). When that space and time is not considered Euclidian, we have other aspects of relationship (§§60-1, 66). We may observe here that '*symmetrical,*' if applied to the One, or to the ring considered as a One and without reference to the arbitrary Many naming of surface B, means just the same as '*unsymmetrical.*' That is obviously true, from this truism:- if the ring, as a total universe or whole, hangs from the forefinger, then except for its *own* arbitrary Many parts, there is nothing whatever by which to determine or to state whether it is "symmetrical" or not (whether its "space"—which in that One aspect is not "used" at all—is "straight" [i. e., Euclidian], or variously "curved" or "warped" [i. e., non-Euclidian]; cf. §38); hence, the twist then is *always* merely the *whole* 180° twist (*regardless* of whether it be *named* 180° or not), and hence is *always* as such absolutely identical *as the same relationship* regardless of any sliding of the ring on the finger. We shall see (beginning at §60) that those very simple considerations (they are merely truisms, which are easily seen by observing the model—as a mnemonic device), are fundamentally the complete solutions of the modern verbal puzzles about non-Euclidian space, whether parallels meet at infinity, 4-dimension or *n*-dimension space, and the theory of relativity. So this paragraph, obvious and trivial as it is just of itself, is important. For some authoritative thinkers get their minds into a soft foggy daze contemplating those puzzles—and all the "evils" of the world result from such states of mind.

§58. a. Taking the ring as a whole, and as representing the three sorts of words, we see first that our three forms of words actually are completely symbolized. The One and the Many are formally contradictory in that the first is not formally separated into parts and the second is. But the ring shows that the two are really the same, and inseparably continuous—that continuity being achieved by the identical relationship or twist.

b. The next important thing is to note that it would be impossible *positively* to express or symbolize a meaning (any whole) unless we use some sort of arbitrary contrast (or a self-contradiction—such as is given by considering B split into Many parts) and subsequent identification of the contrast by a "relationship." The very nature of the matter is a truism, as we have seen before in several ways, and now have before our eyes in a concrete model. So a verbal repetition is unnecessary. —— Many similar models and many valid languages can be made, as is shown in detail in this chapter. The foregoing is merely a statement of the essential characteristic of all those models and languages. And to repeat emphatically, the foregoing about contradiction and subsequent identification refers to a *positive* language. It is not essential that we use *positive* language: cows do not, having merely a few One vocal ejaculations, and cows therefore do not have our verbal puzzles. But cows pay for that advantageous immunity by failing to have a very useful, or "controllable," language tool.

c. And the final rather important thing we can see at once from the whole model is a concrete illustration of the sole logical rule that it is always self-contradictory nonsense to confuse one sort of word with another sort (that confusion being always equivalent to saying $A=A$ and A *is not*$=A$). We see the explicit details of that general rule, in terms of our model, in the remainder of this section. A further extension of the rule, in details from other points of view, is given in subsequent sections (§§59-66) about space and time —that extension amounting to the general principles of measurement or judgment that are in practice used by all people in all their activity or living, regardless of whether they are conscious of it or not.

d. If we make a ring of the strip in Fig. 54c we may consider that ZI is the geometrical line from which we begin to name or number the universe, and $Z'I'$ the line limiting the other end. By usual conventions, ZI is therefore 0, and $Z'I'$ is ∞. Obviously, if we follow more or less conventional mathematics and say that the line at the *end* of a space (or part) is the "number" (§55b), then ZI is *not* a number, but is the *beginning* or *limit* of the first number, 1, of which Z_1I_1 (and *not* ZI) would be the name or number. In brief, ZI is a line not *in* the universe (the model universe), in the same sense that Z_1I_1, etc., are *in* it. Consequently, even if we are going to agree to name an abstraction such as a zero line a number (it can be validly done; but usually it is inadvisable; doing so gets us into other puzzles mentioned in par. f), it is impossible to say that ZI or 0 is a number (or that its coincident line $Z'I'$ or ∞ is a number) in the same sense that Z_1I_1, Z_nI_n, are numbers.

e. The simplest way to consider ZI is to take it *positively* that a number or name actually applies to the part that is in the space between the lines. That actual part is *abstracted* in the mathematicians' idea that a number names just the line. The truth of the matter obviously is that if I say just '2+3=5,' the sentence of itself *is explicitly utterly meaningless*; and hence nobody can have the remotest idea of whether it is true or untrue. In practice, we consider that 2 and 3 and 5 imply "things." Therefore, if we actually supply what mathematics abstracts (cf. next paragraph) then each actual number must apply to a part of the ring, and it is glaringly obvious that 0 (or ZI) is *not* a number, there being no part or space on the ring to which it applies. In precisely the same way, regardless of any other consideration as to "numbers," $Z'I'$ or ∞ is also not a number, but the upper *limit* of numbers. The actual unit space or *part* that just 'precedes' $Z'I'$ obviously has a name that is indefinitely large, but which, if we are rigorously explicit in speech can not be ∞ or *any* fixed "last number."

f. As the mathematicians actually *imply* the space between lines as being what it is the numbers name, regardless of whether they say abstractly that a line—a zero part—is a number, we need not use time and attention showing and seeing in mathematically abstract language that ∞ or $Z'1'$ is also, by such language, truistically not a number. It is broadly obvious that it could readily be done, by considering that there is positively nothing which may be used as a standard showing *how many* numbers there are in the universe, or in our model of it (also, see par. d).

g. When we explicitly consider that the strip in Fig. 54c is made into a ring, then obviously ZI and $Z'1'$ are coincident as ZI, the line-joint—butt-joint—of the ring; or 0 and ∞ are coincident, and the joint may be called the *zero-infinity line.* Clearly, therefore, it makes no difference in which *direction* we name or number when we sum up and begin dealing with the One; or, in an absolute sense "down" and "up," etc., are identical. (That matter of direction repeatedly comes up hereafter; see especially §99b. The essential point of it is that time and space *are* 'direction,' and are arbitrary and simply disappear from the One or real meaning, just as that line which is the 'beginning' and the 'end' of time and space or direction has really disappeared in our model as a zero geometrical abstraction.) —— Also, 0 and ∞ are obviously logically identical—their "lines" coincide. If we are on the Many surface of the ring, and pass over that zero-infinity line, going in either direction, we are then on the One surface; and vice versa. I. e., if at *any* time in language we introduce a 0 or an ∞, or any of their equivalents, we have by so doing shifted from the Many to the One, or vice versa.

h. This paragraph is of slight practical importance, and hence is condensed so much as to be hard to see. —— The relationship words are obviously as a sum total reducible to L and T; i. e., the 180° twist is itself actually a change in direction (i. e., in space during a time). That is nothing but an implication of our second member, M(*varying with*) L^2T^{-2}:- for that member says that M or the Many changes as we pass over space during time. Consequently, it is obvious that if we speak of that time or space as being a Many part of the whole One (if we make a relationship word into a Many word or into a One word), that change implies that we have tacitly assumed the whole of the twist *before* we thus change the form, and hence have formally passed over the zero-infinity line by assumption. In short, it introduces a 0 or an ∞, and if that is not provided for by the context, a logical contradiction results. Hence, we may validly say that we need only one rule in order to be absolutely consistent logically:- do not introduce a 0 or an ∞ without balancing the formal contradiction introduced (cf. §43).

i. The nature of the error of confusing relationship words with others may be observed directly from our ring:- Suppose that it be held, hanging down, with the One or A surface up. Then the upper loop of the ring may be deliberately turned over on the finger (through 180°) so that locally at the top the Many or B surface is now up. We may call that process:- 'going over the edge of the ring.' Sometimes that additional twist put in the top loop of the actual paper ring will simply 'run' itself out through the bottom loop—traveling down through each side of the ring and 'mutually cancelling' itself at the bottom. But unless the paper is rather elastic, that local turn-over at the top puts in a twist of 180° on one side of the upper loop of the ring, and a twist of 180° *in the opposite sense* on the other side—a total additional twist for the whole ring of 360° ("arithmetically" it is 360°). And it is directly observable that the *whole* effect, relative to getting onto the opposite surface (getting from the One to the Many), is equivalent to sliding the whole ring around once (as in §57a), bringing in the original 180° relationship; for sliding the whole ring around is 360° (or corresponds to the universe or ∞—or to 0 and 0°). Now, going over the edge of the ring, to get from one sort of words to another, is obviously equivalent to using a relationship word as a Many word, or as a One word (or, to put it *negatively*:- going over the edge ignores relationship). And doing so, as we have seen, is equivalent logically to introducing the *whole* relationship or 180° twist—or to passing once over the zero-infinity line. Hence, it is directly obvious that all relationship is identical—is that 'twist.'

j. It is further obvious from our ring that all valid logic is circular logic—meaning specifically that it is *continuous* logic, or expression that *in the end* comes back and closes with itself—"checks up," verifies with itself, concludes with the truisms from which it formally started. We may see directly from the model that the reason for all that is that all valid reasoning must have a *complete* statement of relationship, or a relationship which goes all around the ring in order to go *continuously* from the One to the Many, or vice versa. Only such a complete relationship is explicitly a relationship of identity (as we saw, from a somewhat different point of view, in §57b). If we go over the edge of the ring we clearly have not *explicitly* put in a *complete* relationship—which was in the last paragraph emphasized by the concrete fact that a two-sided contradictory twist was thus put into the ring. If we go over the edge, we say $A=A$ (that A is, say, a Many unit), and then simultaneously (on the other surface) we say A *is not*$=A$ (that A is the One); obviously, A is *ultimately* the One, but the way to get it expressed as the One is not to talk fast and loose that way, but to follow our agreements and go through all time and space, identifying it with *all* others of the Many—that being equivalent to *sliding* the ring around. Get-rich-quick schemes won't really work, even with mere words.

k. All that of course is rather confusing at first. The model helps to make it concrete, and gradually clears up the confusion. The actual difficulty lies in the fact that although time and space are primarily used to express relationship, we often use them as the other two sorts without noticing the differences. I merely show how the change from one form to another must be explicitly made. We can acquire such conscious skill in the use of words only gradually: for familiar affairs we instinctively have that skill, but we get confused in less familiar affairs—to the extent of agnosticism.

l. The model, besides serving to help us consciously avoid the customary confusions of the three sorts of words, gives a clear insight into the solution of *What is real?* or *What is truth?* Taking it in terms of the Trinity, we see at once that neither (1) the God the Father or One surface A, nor (2) God the Sons or Many surface B, nor yet (3) the God the Holy Ghost or relationship twist, is itself (regarded separately) the ring or "reality." Nor is any combination of any *two* of those the ring or "truth," or the universe. Obviously, only the three together are real or true. Consequently, the valid or dynamic logic (§49jl) which takes it that each part, as it comes up, is real, simply means that one part, if it is intelligible, implies the other two. Hence, the dynamic or everyday logic is shown to be ultimately true.

---

§59. a. We may now see, by this model, just why there are three dimensions of space, and not some other number of dimensions. Our final conclusion is going to be this simple one:- we have devised (invented; agreed upon—perhaps mostly unconsciously in the past) for everyday use the language with the fewest possible forms or dimensions that

could still be positive or explicit; three-dimension space contains the fewest number of dimensions out of the infinite regress $L^{\infty}T^{-\infty}$ that oould explicitly be so. —— In getting that conclusion we shall see that an unlimited series of otber sorts of languages is possible (cf. §38a; and as indicated before, English, French, etc., are "different" languages merely in having somewbat different vocabularies; formally or logically they are the same). This investigation of the number of dimensions of space is obviously a *quantitative* one. There is no absolute necessity about using *three* dimensions: there is no absolute necessity that we use language, or any space. *Three* dimensions are "necessary" only *if* we are to talk in the easiest, shortest, or "simplest" way. It is a fundamental law that we do act in the path of least resistance (with ultimate accuracy:- in the path of *no* resistance; §§98m, 104). Consequently, acting according to that law witb more or less consciousness or explicitness, everybody takes it for granted that we *are* going to use the simplest language. So the reader need not fear that I am going to inflict any new dimensions of space and-or time on him. I am going to show that those who try to do it, and those who try to assert the "reality" of other *kinds* of space [or time] (such as the "two" non-Euclidian spaces, and the variable space of the relativitists), are implying different languages—and are usually failing to completely formulate and use those other languages, but merely indicate implicitly their possibility. So of course, as a truism, their different sorts of space and time are not intelligible when expressed in ordinary terms of everyday language: such spaces logically contradict that everyday language (assert that they belong in other, different languages). —— In order really to understand our language, and use it without making verbal puzzles for ourselves, we need to understand how to make those other, different languages. At the same time we thus protect ourselves from ever taking seriously, or being puzzled by, the introduction into *our* language of such contradictions of it, *when taken as belonging in our language*, as 4-dimension space, etc., which by no means whatever express *any idea* in *our* language. We are not familiar with those other languages, of course; so my description of them will truistically be a bit novel and strange—even to the mathematicians whose familiarity extends mostly to views that aren't so. Unless the reader is a professional scientist, philosopher, or mathematician, or intends to become one, he does not need to grasp especially well the details of the rest of this chapter. If he merely reads it casually he can get all that interests him.

b. The model ring is, as a model, considered to be a standard universe; i. e., we use it *as* a universe, neglecting the remainder of the universe; it is, so to speak, *abstracted* from everything else, and is, in that abstract condition, for the moment, the whole universe logically. Consequently, every standard universe is obviously an abstraction. When we are talking, and using the valid dynamic logic, considering each sort of word temporarily real, that reality is an abstraction—for the whole reality comes only of *actually* supplying the other two forms. Hence, we see that any use of language, or of any sort of symbol or model, involves a tacit *temporary* abstraction. That is equivalent merely to the quite obvious fact that *we can not say everything at once*. Consequently, we shall carry the idea *abstraction*, with reference to our model, to the end, and see what we get. After that, we add everything to it, and get surprising conclusions.

c. We have been considering the ring to be of negligible thickness. If it has zero thickness obviously the two surfaces are coincident (as well as being continuous). If the surfaces are thus absolutely coincident, it is obviously verbally contradictory (or nonsense) to say that there are two sides. But the fact is that it is nonsense to say that there is any such thing as a geometrical surface; for such a surface is what is left of (say) a cube when the cube is *wholly* removed; obviously, *nothing* is left. Consequently, it is obviously sensible (as the cancellation of two nonsenses) to say that there is an upper surface A and a lower surface B of the ring when it is an *abstract* geometrical surface. —— Please keep those apparent trivialities slightly in mind for a moment.

d. This model ring has been tacitly taken to have some breadth. The one we made was casually said to be about an inch wide (§54a). It is obvious that the 180° twist (the essential relationship that establishes ultimate continuity of the two surfaces) requires that the tacitly accepted breadth be warped some. Now suppose that we make the ring still more abstract than the mere geometrical surface, and thus take it to be a *line*, without that breadth. We may consider that line to have the surfaces A and B, and to have the 180° twist (and the line in taking that twist would obviously have no warp). It clearly is formally explicit and cancelling of zeros, to have that line with two surfaces, and hence be thus 'twistable': see last paragraph.

e. Therefore, we now have it, in considerable abstraction, that the universe may be completely represented, in a positive way, by a point, of *no* dimensions, (1) moving in a line, and (2) turning or *revolving* so as to form a closed ring, and at the same time while describing its closed path, (3) *rotating* or twisting 180°, so that its original side A joins *in formal continuity* the originally opposite side B. In that somewhat abstract model, obviously we need make no *real* demands, or have any *real necessities*, as to time and space:- for the *length* or *space* of the point is zero, non-existent, or not real; the *length* or space of the closed path *may be* taken as zero, and the *time* of that revolution hence zero; and then obviously as a further truism the rotation will require zero space and time. In short, *making the closed path of no length*, the *ring* has become a completely abstract, or zero, point—although still formally or logically a ring, and hence representing formally the three parts of the Trinity. The model contains *no "actual quantity"* of space and time; but it does contain the *forms* of space and time, as we see in the next paragraph. It is obvious that our model, and with it the formal requirements of language, is here reduced to the very "lowest terms." Any further reduction in the *form* will destroy *formal* language and give some incomplete language described in §62c. (We have already subtracted the total substance, or Many actuality—and also the One reality, in our everyday usage of considering the One "infinite", although in a Buddhistic sense of zero reality, and also obviously in strict logical technicality, One reality remains.)

f. (1) It is obvious that as the point *moves in the* zero *line path* it *formally* does *one* thing (i. e., that doing or moving in a line constitutes "one dimension" of "space"—really constitutes "one dimension" or 'one formal part' of the One, or of whole reality or the complete ring [see §58l], or of being, or existence). (2) When it *revolves* so as to close on its path and make the path continuous or the One it *formally* does the second thing (and that revolving constitutes one more "dimension" of "space," giving now "two dimensions." (3) And when it *rotates* or twists so as to relate those first two contradictory forms, it does the third, and obviously last, *formally* necessary thing (and that is one more "dimension," making finally "three dimensions"). —— Obviously, no fewer forms will serve. Equally clearly, if any other is added we have taken at least one step on the infinite regress of possible languages (§51h), and we then have *not* our everyday language, but have a language that is *at least*

'duplicate,' and hence formally different from ours. Those three *forms* are the "three dimensions of space" (for obviously each form was a needed sort of "motion" in a hence formally different aspect of "space"—i. e., *motion* and *space* are formally or logically synonyms). Clearly those *three* constitute the lowest practical and still positive reduction of the infinite regress $ML^{\infty}T^{-\infty}$, where M is the "thing" or that point. The whole of Part Two may be considered (although explicitly it is nothing of the sort) to be a description of a point moving in a closed path in that way (§§98m, 104).

g. In no case in the last two paragraphs need the *formal* model occupy actual "space," in our everyday usage of *space*. We have actually been using the Buddhistic 'negative' form of zero-space: for a primitive or original statement, such a form is easier to grasp—and for that same general reason or truism, Buddhism historically preceded Christianity, its equivalent in "infinite" or 'positive' terms, by five centuries, it taking the race that long to grow the few needed nerve connections. So we may now consider the ring (which is still our zero point) to 'depart' from that condition, and acquire some "room" or space for the M (now also become "actual") to move in. The only logical way to get those zeros or abstractions into 'positiveness,' or into the other aspect of the One (the infinity aspect) is to multiply them by infinity. We then have a "solid" ring, still indeterminate (i. e., ∞) as to the *measure* of *all* the space, but containing "space" *and* time in usual meaning—though they are obviously merely the same verbal *forms* as before. Or, the ring now has "real" length and breadth (and real but negligible thickness—see §63f for explicit consideration of thickness), and we have the usual conventional but arbitrary space:- for obviously, in our usual convention of an infinite One, we now have in our model that represents the universe a "length" (etc.) that is "infinite" (i. e., continuous), and the three forms occur just as before, in, or as, 3-dimension space—a truism. —— That is the total "mystery" of the three dimensions of space. We are so in the habit of using those briefest, simplest means of talking that *all* parts of our language imply those three dimensions or forms. So when we speak our language, it is a contradiction—utter verbal nonsense—to say that there is any other number of dimensions: for such an assertion says that "now another language will be talked while we still talk our ordinary one." It can be noted that as soon as I explicitly made the ring of *no* thickness (of two dimensions) in par. c, I abandoned our ordinary language, and was talking nonsense with reference to our language and said so (even though the language I was using *is* the language of "plane" geometry, and quite conventional). And when I reduced to zero dimensions I was very nonsensical. So I had to balance or pair off those contradictions to our everyday language, and do it *explicitly* to be intelligible; and that obviously consisted of *really stating our forms* (which are the real "three dimensions"), and thus actually talking of three forms of zero space—or, I reversed language into Buddhism, that being the reverse of the truism mentioned above. —— Hence, with those evident truisms, the foregoing proof of the existence and meaning of three dimensions is quite rigorous. That proof is, I think, the hardest thing to state and understand, in this book. That is because it is so obvious. Ordinarily, we simply say that we "see" that we have to use three dimensions to talk about things *definitely*. And that is substantially all I have said above—only I stated it in detail from a different point of view, so that it was possible to see definitely that the matter of dimensions was simply getting the *fewest parts* in a language machine, just as there are three parts in the "simplest" machine, the lever:- load, power, fulcrum. Also, the foregoing argument is much easier to see in §62c, where concrete examples are given of languages having other than three dimensions.

§60. a. When we start to describe the universe, we take it that there is something (whatever it is) to talk about (§22). When we similarly 'assume' (i. e., agree to invent) our ring model, obviously we in the same way, all in a lump take the three sorts of words as being definitely bound together. I introduced no complications, but took the barest agreements:- a contradictory One and Many reconciled by a single or 'identical' relationship or invariable twist. We saw in §57b that in absolute or One *meaning* (taking the ring as a whole, as we must do to get any final intelligible meaning) that relationship between the One and the Many could be only of one sort, regardless of whether the ring was symmetrical or asymmetrical. (That is merely a special case of the principle that the One is ineffable.) We also agreed (in §57) that we would consider the *actual* ring to be perfectly symmetrical, as the means of getting our ordinary language. In this section we see the *formal* changes in language if we regard the model as being unsymmetrical in various ways. There are an indefinite number of quantitative ways in which it can be asymmetrical, each of which gives a different *formal* language, although every such language means the same as a whole. Those changes in form are conventionally said to be different sorts of "space"—"curved" or non-Euclidian.

b. We considered the ring to be symmetrical because that gave the simplest, *average* sort of language; i. e., if we take any part of the ring, or unit of the Many, such as Z_1I_1–Z_2I_2, we may name it 2, and then—*if the ring stays symmetrical*,—regardless of the relative position of 2 (regardless of how we slip the ring around when hanging over the finger and thus changing the place of 2—regardless of where 2 is in the universe) that 2 *remains formally or lingually* the same; its *relationships* or L and T, with respect to the *whole* ring *stay steady*, or are *average* all the time formally; or the degree of twist and warp does not change. *But* if the ring is not considered symmetrical that part is obviously not warped in an *average* way (so that it does not take a proportionally average share of the whole 180° twist); consequently, if we write for 2 its full general name $M(varying\ with)L^2T^{-2}$, the L and T of its name are always varying or varied just in mere *form*. The reader possibly can not yet grasp that condensed statement—can not see just what happens to language when the *form* of the language, or what we have called relationships or L and T measures of units of the Many, (1) varies all the time, or (2) departs or is varied from the average in Euclidian space, and hence, for a given non-Euclidian space, has a "steady curvature." The relativitists make L and T always vary—technically over all quantitative degrees of non-Euclidian and the average Euclidian spaces (§66). And as neither the relativitists nor non-Euclidians grasp the ultimate meaning of what they do to L and T there is in existence considerable strange, weird, esoteric doctrine which tends to have the same hypnotically benumbing effect upon the brains of the authors and some of their hearers that the logically precisely analogous weirdly nonsensical incantations of ancient medicine men or priests had on themselves and most of their hearers. Both tend to superstition—fear of the fancied unknown. Such hypnotic deadening or fear in some degree precludes seeing things as they are, and hence prevents men from being as alive as possible. So it is of value to investigate those possible variations in language, especially as doing so further shows possibilities which may be of some use. For those languages are not "wrong."

c. Some mathematicians substantially claim that there is no "proof" that our ring *can* ever be symmetrical in any

portion; so that if we use Many words the same *words* (or forms) because of such lack of proof, by the theory of probabilities constantly mean something else, and that therefore if we use relationship words there is no continuous identity of relationship anywhere (i. e., in any finite space and time —meaning that those mathematicians assert ignorance as to the sum total of relationship). Again such a general condensation is possibly not quite clear to the reader. The statement is equivalent to the orthodox claim that there is no "proof" of one of Euclid's "axioms" or postulates (but ought to be, if it is used):- Euclid defines parallel lines as straight lines which, being in the same plane and produced indefinitely in both directions, do not meet. And the postulate, in common form, is:- through a given point not on a straight line, one straight line, and but one, can be drawn which is parallel to the given line [I give the proof of that postulate in par. i]. The mathematicians say that in the absence of "proof" of that postulate, there are *two* general sorts of possibilities:- (1) It can be assumed that every straight line through the point [and in the same plane, of course] will cut the other line. That gives Riemannian or "elliptic" space—Riemannian "geometry" [or really a new space language]. It is equivalent to saying that our boundaries Z_1I_1–Z_2I_2 of '2' vary in such a way as regards their distance apart that the L (*and* T) between Z_1I_1 and Z_2I_2 at some point becomes absolutely zero—or any such word or possibility of such word as 2 disappears: we shall not examine the details of the new language that results; in general, the Many word '2,' or M in $M(varying\ with)L^2T^{-2}$, would vary in a way not conceived in our *average* language. (2) Or, it can be considered that *two* lines (including some angle between themselves which can contain an infinite number of other lines) can be drawn which are *both* "parallel" to the given line, in that they do not meet it, so that those two lines form the limits of the infinite number of other lines lying between them that also do not cut the given line. That is Lobatchevskian or "hyperbolic" space and geometry. It says that in our '2' or M represented by Z_1I_1–Z_2I_2, Z_2I_2 may be *two* intersecting lines which do not ever cut Z_1I_1, so that there are really an infinite number of parts or M's all of which are named 2. Well; we *can* make a language of that sort if we like; again I shall not go into the details, but below we see the general implications as to such new languages. —— The Euclidian or ordinary geometry considers space as "flat" or "straight" or average (i. e., there is one set of two parallel ZI's which formally fix the 2 with a *steady* or fixed or "straight"—i. e., undeviating—space, or really *form*); the other two sorts have "curved" space—i. e., are two languages where the *forms* or ways of naming depart or deviate from the average: one on either side of the average. For a somewhat technical orthodox account of such spaces see "Ency. Brit.," xi, 724 to 735 (in Art. "Geometry); or for a good popular account, see "Science History of the Universe" (New York, 1909), viii, 143-52 (in the same volume is a more technical account —pp. 230-36—by Keyser, a leading mathematician). Those accounts are not really intelligible unless something be added to them (as we shall see). Consequently the reader need not worry if he has failed to understand the condensations of them which I made in the first part of this paragraph. We shall now begin with the fundamental orthodox assertions about those curved spaces, and get at their real meaning.

d. The same Art. "Geometry" (pp. 730, 733) states that there is an unreconciled controversy about *space*, it being shown substantially (on p. 730) that space is considered (1) as the One, (2) as the Many (i. e., in the paragraph "Axioms":- a space "known only from experience"—as contrasted with "a priori" or One space—is obviously a Many word), and (3) as relationship. [It therefore follows that orthodox geometry would tend to mix the three forms of space—not meeting the fundamental logical necessity of distinguishing apart the three: it does rather mix them in the article I am quoting from.] Then it is shown that a valid geometry [or what we have been calling a valid logic or language machine] is merely one that is self-consistent, regardless of what arbitrary agreements are made. And two general sorts of valid geometry are distinguished:- (1) "In projective geometry any two straight lines in a plane intersect, and the straight lines are closed series which return into themselves, like the circumference of a circle" [i. e., a "straight" line is a string or series of points that have a closed path: that is Riemannian or elliptic geometry]. (2) "In descriptive geometry two straight lines in a plane do not necessarily intersect, and a straight line is an open series without beginning or end. Ordinary Euclidian geometry is a descriptive geometry: it becomes a projective geometry when the so-called 'points-at-infinity' are added." [That is Lobatchevskian or hyperbolic geometry; and it is more rigorous to say instead of that, that Euclidian geometry is the average geometry that is the *limit* of (1) and (2)—the geometry that lies just between the two.]

e. We now come to the illuminating facts regarding those orthodox sorts of geometries—still quoting from the same place:- Projective geometry is developed from "two undefined fundamental ideas, namely, that of a 'point' and that of a 'straight line.'" Descriptive geometry is developed from two undefined "fundamental ideas, namely, of points and segments." A "segment" is a *part* of a straight line, the development of which into an [unlimited] straight line can be provided for.

f. It is obvious from an examination of those two orthodox beginnings of formal language or "geometry," that those geometries *start* by taking (1) a *typical* One (i. e., taking a *line*, which is considered and more or less described as a *continuous* "idea" or whole), and (2) a typical Many (i. e., a point). It is then obvious that the two are formally contradictory; and that they are also two abstractions that imply essentially (2) zero (a point is 0), and (1) infinity (a line, as an indefinite series of points, is ∞). Hence, relationship terms obviously (as a truism) must be explicitly introduced in order to reconcile that formal orthodox contradiction—which the orthodox theory does then *vaguely* introduce, as space-passed-over-during-time. But then it is obvious further, even to the orthodox theory, that in those 0 and ∞ "fundamental ideas" *there is nothing* whatever *positive* (or *explicitly* agreed upon) by which we may say whether space (during, or *and*, time) is a 'steady' term—an 'identical' term. So very clearly, consistently with itself, that space is itself forced to take upon itself *in addition to its relationship capacity*, the further capacity of an *explicit* or positive Many word (for obviously the formal or "fundamental" Many word "*point*" was not *positively* a Many word, but merely an ineffable word *zero*). Therefore, in such orthodox geometry *space* (and time—*time* is *always* implied by space—§150,—as I shall take for granted will be understood by the reader) takes a *double* meaning, and *when used in our average language* in one of those meanings (the Many meaning) *must take on variability* (for bodies or units of the Many do vary), while in the other meaning (the relationship meaning) *it would be steady*, or 'identical' as a form in language. The mathematicians perhaps see that in the actual, observable world "space" *as an M* or a Many body does vary (I do not venture to say positively what, in their confusion, they do see). At any rate, as there is orthodoxly no agreement (nor

really any essential necessity) to make *space* in its second capacity as a relationship *formally* or verbally steady (*except* that the sum total or One is always identical, so that steady space is simpler: cf. §38a), the mathematicians let their *space* (including *both* formal meanings, so far as I can judge from what they say) *vary*, and as a result we have the two *sorts* of non-Euclidian space (in addition to the average Euclidian space lying as a limit between the two), in one of which the unit of L in a sense varies in one direction from the average, and in the other sort in the 'opposite' direction. —— That of course would get them into difficulties with actual M's, which are *cyclic*, or vary about a mean in both directions: but the mathematicians do not go on and finish formulating their languages, so apparently do not notice such practical difficulties. Neither do I finish those new languages, as we have no present use for them; but I indicate the general results of using them—some valuable.

g. There is obviously no *logical* reason why those two different geometries or "space" should not be used if desired. They *are* self-consistent—even with *space* implying that duplex-meaning, one of which orthodox mathematics fails to express definitely, so that it has an unreconciled controversy. But there still remains one omission in the foregoing statement of those orthodox geometries (I think that orthodox mathematics vaguely supplies this one just as I do below; but that duplex-meaning of its *space* confuses its statements so much that it is not safe to make any definite assertion as to what it does say):- that variation of L as yet has nothing to fix its *measure* in any *given* language or geometry: i. e., L can be continually variable, as in relativity; or its "curvature" can be *definite and steady* for a *given* language. —— The only possible way to "catch" those varying languages and pin any one of them down so that we can use it *positively* whenever we wish to talk among ourselves and hence know that we are using at least approximately the same sort of language (are all referring to the same sort of space, that hence has approximately the same "measure of curvature"), is to revert to our ordinary *average* Euclidian space for a *basis* or standard or 'center' or 'verbal potential' of such measure. In that Euclidian language we *arbitrarily* say that we will take (say) ourselves (we *could* take anything else, but usually do not) as a standard universe, or a unit of measure or quantity, as a sort of average, in spite of the fact that we are not all *in* or *at* the *same* L (which introduces minor quantitative error or inexact science). —— In short, the non-Euclidian space, *strictly* as such, has no possible means of *mutually* indicating a quantity. And the logical truisms or reasons why we must revert to Euclidian space in order actually to talk *together*, are these:- Euclidian space, in terms of those infinite possible formal spaces that are quantitatively different as to degree of curvature, is the space whose radius is infinity, and whose curvature is hence zero; consequently, we have a formal 0 and ∞ to balance with and cancel the 0 point and ∞ line with which those spaces formally orthodoxly started (par. e): the two nonsensical abstractions are cancelled into sense by two opposite nonsenses, and we have ordinary space which omits including in itself the Many sense, and requires that some definite Many or quantity standard be used, there being no longer any formal possibility of using the sliding scale. Therefore, it follows that although an indefinite number of languages are validly possible in terms of, or as, non-Euclidian space, each of those languages, in order to become positive (i. e., in order to have, say, any valid right to use our *average* language word "*curved*," as they all do, although the word then *in those languages* has no such meaning as "curved"—that being a truism), or in order to be anything other than a *formally* valid mysticism *absolutely* incapable of *explicit* communication, *must* be translated into Euclidian space (cf. §66).

h. Because our standard quantities in Euclidian space *are* arbitrary, it of course follows that in an absolute sense *they* are not verbally communicable from one person to another. That is a mere truism. But as Euclidian space is the average of all possible actual or factual quantitative variations, by using it we theoretically achieve an average quantitative error in understanding each other that *in the long run* cancels into zero. Also, by using that average space, and asserting what is the fact about it (that there can be no quantitative accuracy—no exact science), we obviously achieve absolute qualitative consistency. In short, the *intelligible* complete translation of what the mathematicians mean by non-Euclidian space is this:- *there is no exact science.*

i. It therefore follows as a truism that the reason Euclid's postulate about parallels can not be "absolutely proved" in the classical logic sense (which is irrelevant anyway: cf. §35), is because it is a tacit arbitrary agreement that we shall select some part of the Many as a standard *quantity*. It is not a postulate, proposition, or real assumption at all, but our agreement (§22) to say *formally* that $A=A$, and to *keep on* asserting that *formally* A remains A or $A=A$, even while recognizing that any *actual* A, such as a metal bar, keeps on perceptibly changing: obviously *only* if we have that 'fixed' *form* A is it intelligible to say that the *actual* A changes. —— It happens that Euclid's way of saying that the *formal* quantity is agreed not to change involves the term *infinity*. I. e., he in effect said:- parallels are the same *quantity* (or part of the Many) distant from each other *here* (at 0 distance) *and* everywhere else even at infinity (at ∞ distance); *or*, $A=A$ every-*where*, which is the same as saying in §22 that $A=A$ every-*time* (§§150-1). As the mathematicians rather habitually use that term ∞ in two different senses, naturally a direct confusion arose, and it was irrelevantly held that the agreement was "unprovable." But Euclid's postulate is however obviously validly provable (i. e., can be shown to be a truism: §35) as soon as we stop using the same word confusedly in two senses. It is an agreement (an arbitrary verbal truistic invention), and hence not absolutely provable in the sense of §35. *But* it is provable in the same sense that *any* of geometry is:- I. e., the postulate is precisely the same sort of proposition as the theorem that from a point not in a straight line a perpendicular to that line can be drawn, and but one. For in that theorem the perpendicular is the *distance* or *Many quantity* from the point to the line. Because the perpendicular is *here* (at presumably a *formally* 0 distance from us), it is held to be always of the same length. But obviously, in fact, it is *not* at *exactly* the same distance from each of us, nor at *zero* distance from us in any given case (for we do not in any Many sense coincide with a "perpendicular"); we are the differently located *observers* of the case. Consequently, *if* that perpendicular distance varies *any* when changing its distance from *absolutely here* (0 distance) to *any* distance away (and Euclid includes *all* such distances in his postulate by saying ∞ distance), *then* in no case can the proposition about the perpendiculars be considered to be "proved" (or for that matter, even to be true) to anyone except the person impossibly coincident with the perpendicular. Hence, if the theorem about the perpendicular is considered by the orthodox mathematicians to be proved, in exactly the same way Euclid's postulate is proved. —— That is condensed, and hence roughly stated from a mathematician's point of view. But it proves with rigorous truisms either that Euclid's "axiom" about parallels is proved, or else that all kinds of geometry (including non-Euclidian) are not only unprovable, but are in the

same sense disproved, or proved to be erroneous. The actual fact is that we have merely rigorously established the preliminary formal agreement of language or geometry—Euclid's postulate being that agreement in one form.

§61. a. That leads us specifically to what I believe is generally considered to be the unsolved problem of whether space (*and* time) is *really* Euclidian or not. The solution of it—already implied above, of course—is that there is not any such problem; it is merely an implicit self-contradiction and confusion to propose such a "problem." We may profitably explicitly consider it, as it shows the ultimate details with regard to confusing the three sorts of words. —— (1) If space is a relationship word or God the Holy Ghost, as we explicitly consider it to be in our general equation, then obviously there is no such Many or "objective" *thing* as space, and no possibility of its having anything but merely a whole identity with itself (§§57, 60a). The problem of "Euclidian space" is obviously meaningless or non-existent from such a point of view: *space* in this first sense is solely an absolute assertion of connection, or identity—and identity is identity, it being nonsense to consider in curved or flat. (2) If space is the universe, the One, then it is Euclidian or non-Euclidian just as we please. Neither mystic statement has any definite meaning as such, and both are "true." (3) If space is used as an actual unit of the Many (as meaning, say, *that which* is named by *cubic yard*), then obviously we can say that that space is *formally* a fixed quantity or *standard* One, in which case (2) again applies. But if we observe that *'that which'* at first was in the space *changes* with reference to other parts of the Many, and say that it no longer fills the "space," then we use that last term "*space*" (a) vaguely in a Many sense, and *also* (b) in a relationship sense that is covered by (1), but which is explicitly, as a standard One or measure, a Euclidian space. Or, instead of saying as in (b) that such a space measure did not change, we may with the mathematicians say (c) that the space measure also changed with the change in *'that which'* or Many part in it. *Then* that assertion of change, as a verbal truism, implies that we have *assumed another* "form," or a *second* "space," which tacitly assumed form is the relationship word, *but* which second space is *then*, by orthodox mathematics, inserted into (i. e., verbally identified as, or *duplicated* into) the original name *space*. (The original *space* would then have to change *again*, and be fixed as a form; and so on ad infinitum. It is, from this point of view, the infinite regress of language: or more definitely, that simultaneously *duplex* "space" is the mathematicians' unrecognized way of asserting the infinite regress; or more concretely, that duplexing of "space" is the ancient infinite regress of ethers; cf. §51.) In that case, where we get flung on an infinite regress of spaces (which is another way of stating the last section), *each* space that changed in some given degree *is a distinct language*, of non-Euclidian space. And clearly, to interpret that language, we simply have to revert to the formal or fixed space, which obviously is the average or Euclidian space. Or, briefly and obviously, there is no such *thing*, or unit of the Many, as space. To say "Euclidian space" is, *strictly*, the same thing as saying "motherhood of brotherhood"—logical nonsense. Hence, there exists no such problem as whether space is Euclidian. "Space" is a verbal invented agreement as to the expression of universal identity, and the Euclidian agreement is the average, intelligible one, and no other is *mutually* quantitatively intelligible.

b. It may now be seen why we have gone to so much trouble and effort with what is superficially the rather foolish business of investigating non-Euclidian space. Two important advantages appear at once:- (1) We have very definitely seen just how a word is orthodoxly confused in the three meanings (and how excessively confused that confusion may be), and just how to dig the word out and unsnarl it. The non-Euclidian space serves as the type: no other mixing can go further in confusion: yet, at the same time, if we have nothing better to do than juggle words, it is possible to make *valid* expression of anything in terms of non-Euclidian space (but to be quantitatitively intelligible expression it then has to be translated into Euclidian). (2) And we have seen how very flexible our language is. If we do not explicitly pin it down to Euclidian space, *any* noun in it can be given not only *any* meaning as a One (which is validly possible in our everyday language—we must simply point out that we are doing it); but can also be taken as *any* quantity as a Many (§66); and can further, from one point of view, be considered (a) steady, or (b) in any way warped as a relationship, in which case it implies an infinite regress of different formal languages—*all* of which then have to be explicitly stated in order to be intelligible (and the way to 'state' all of them logically, is to state the average, or zero, or Euclidian one). Consequently, it behooves us to understand our logical rule about 0 and ∞, and use it, if we do not wish to find ourselves adrift in non-Euclidian unintelligibility, or the dupes of the men who are.

§62. a. The scientific physical theory of relativity (§66) is a variation from ordinary language of the same character as are the non-Euclidian varieties. That theory uses "time" as if it were a fourth dimension of space (§66g). Non-Euclidian geometries often do the same thing ("Ency. Brit.," xi, 735). In both cases the usage is merely a form, and implies no actual "fourth dimension." In this section we consider the actual meaning of all asserted and verbal departures from three dimensions.

b. We have seen (§§58ab, 59) that our everyday language was reduced to the most parsimonious terms possible in an *explicit* language, and hence had three dimensions of space. We saw that they were *forms*; hence, it is already implicit that, as a form, there might be any number of "dimensions." But we proceed to examine the details. —— The Euclidian everyday language and each of the non-Euclidian possibilities may be varied into an infinite number of valid languages which depart from that simplest form. So far as I can determine from the vague statements of orthodox mathematics that possibility is not definitely recognized by it. But orthodox mathematics in an indefinite way begins the construction of such different languages:- e. g., various branches of mathematics treat of "space" (1) of *no* dimensions (points); (2) of *one* dimension; (3) of *two* dimensions, etc. As we shall see, the three varieties of "space" just mentioned explicitly, actually imply the use of languages that are logically different from our ordinary language. But it is not conventionally so considered. It is considered that we can "conceive" a "space" of say two dimensions. The fact is (the absolute truism is) that we can not conceive any such space in any way really different from conceiving a space of a million dimensions (and we can not properly talk of either the 2-dimension or million-dimension space in our ordinary 3-dimension language—as we shall see). The usual conventional assertion is that it is impossible even to "imagine" a "physical" space [i. e., a Many unit as *usually named*] of a million dimensions. Of course it is, as that is an essential contradiction of terms; in precisely the same everyday sense it is equally impossible to imagine a space of two dimensions, or *three* dimensions, as we shall see.

c. What we are going to see now is that there are possible an indefinite number of valid languages, each of which has a different *formal base* (or, in some cases, *lack* of formal

base, or *negative* one—which is logically the same). The language which we actually use (§58) is based on the Trinity, and is the simplest *positive* language. It has three forms of words, conventionally necessitating the three dimensions of space (§59). —— Following is a description of the formal base of four different languages:- (1) The most primitive 'language'—I doubt if it may properly be called a language—is one merely of ejaculatory sounds, such as a hen usually uses to her chickens. It is rigorously "mysticism," and implies *only* the One, or meaning. Actually, it has no "words," as any of its 'words' may, just as a One word may, be used to designate any complete meaning. That 'language' does not use space at all—has no form,—and is hence of *zero* dimensions. (It is also obviously of *infinite* dimensions, as it *implicitly* includes all possible forms.) Conventionally, that is not a "language." —— (2) A hen can and does use another and "higher" form of language. When she finds food she sometimes adds to her previous language a gesture of 'pointing' or pecking at it (and perhaps a vocal sound equivalent to that gesture), indicating a point, or a *no*-dimension location in space (*and* time—always understood). A small child is "verbally" a little more explicit in such a language. He puts his finger on or towards the "point" and says "This" or "That," or some word corresponding formally to the mathematicians' "*point*." That also is a language which is not positive—and conventionally perhaps is not recognized as a language. That 0-dimension *form* of word is the primitive Many word, and such a word is *indefinite* as to whether (a) it is a unit of the Many that is a *formal* part of the One, or (b) is a mere *formal* recognition that the One may be arbitrarily divided, but is not such a part. It has been seen (e. g., in §58d) that orthodox mathematics is still, like the child in that language, ambiguous as to its general Many words:- number. Hence, it is obvious that when mathematics speaks of "points," or technically of "number," it probably is attempting to use this no-dimension 'language,' without recognizing that it is not a *positive* language. This 'language' formally and implicitly asserts space or form, but explicitly asserts *no* space. But there is no trace in it of the relationship *form*—note the indefiniteness under (a) and (b) above. Obviously, as this language uses space, and denies dimensions, it may be said to have no logic, or be negative logically; yet it is fairly intelligible in practice, and is often eloquent—for it raises no verbal problems and needs no formal answers. This zero-form or zero-logical language may be held to include the absolute mysticism described under (1). —— (3) The next 'language' is the one in which the motion of a point is formally recognized—the *continuity* or relationship that is explicitly a *one*-dimension line formally explicitly asserting the Many, but obviously not fully separating the units of the Many. Hence, *relationship* is explicitly used, but formally it is denied or omitted. This 1-dimension language is still not a positive, controllable language, as it obviously still lacks a definite logic. —— (4) The next language is one of 2-dimension surfaces, in which the One is obviously explicitly separated *formally* into the Many. *Relationship* is obviously implicitly used, but it is not explicitly named *as a form*—it is, when it comes into explicit notice, pseudo-invented as a *thing*, or another unit of the Many, or a tertium quid, or God. *This is actually the language the dualists use.* It is not a positive language—not our Trinity language. It is, compared to our positive language that has the minimum of logic or form needed for controllability, a nonsensical language—practically more nonsensical than the languages of the hen and the infant; for those make no pretensions. Dualists are not "wrong"; this language is not "wrong," as it is fairly intelligible, and is actually the language of most of conventional mathematics. It merely is not *complete* and it is not our everyday dynamic language. *Strictly* speak-speaking, it is a barbaric language—half-formed; static.

d. Obviously, just as soon as we say above in the language (2) that there exists *one* way of asserting and denying "space" (or the formal distinction between the One and the Many), it immediately follows that there can be *two* ways of doing it—and two were shown in language (3),—and then on and on in a balancing of such forms, in infinite regress. We saw (§59) that the first way in which the whole set of contradictions is explicitly or positively handled is our Trinity language. Hence, that Trinity language is what is ordinarily known to us as "language." But obviously, the other forms pointed out in the last paragraph are languages —even though they differ quantitatively in the number of explicit forms or 'logic.' So those are concrete and conventional examples showing the possibility of an infinite regress of languages with different forms which are valid (although not equally useful in quantitative Many affairs) so long as they make no claims to be other than they are (the real objection to dualism and other languages with queer numbers of forms is that they make false claims for themselves).

e. The mathematicians call each such assertion-denial (*formal* assertion of a splitting: denial of it) a "dimension" of "space," and get thus 4-dimension, ...*n*-dimension... space. Obviously, what they can mean is correct; the names they have adopted for it are not enlightening and usually puzzle even themselves. For obviously, in no case have they got a "space" that is a bit different from the one the child has when he merely 'points' and has 0-dimension "space"—i. e., has *no form* in language, no technique, no trick of talking. The actual difficulty the mathematicians have is due to the fact that ordinarily we consider the forms of language explicitly in terms of *time* (*with space always implied*; cf. §150); but (as in §60i) Euclid shifted those forms explicitly to space—making a "geometry" instead of a tacit "psychology,"—and instead of talking of every-*time* talked of every-*where*. Because of the nonrecognition of the existence of those two aspects of precisely the same essential principle of form, the mathematicians thought they had something really different in the way of language variation.

f. It therefore follows as a truism that when a man undertakes to talk about a space of (say) four "dimensions" as being one in which (say) we could go in and out of a room which was "closed," then he is, in his mental confusion, attempting to talk two different languages simultaneously:- our Trinity language of the "closed" room, and the 4-dimension language in which he describes the path "out." The result truistically is nonsense—saying $A=A$ and simultaneously A *is not*$=A$. Competent mathematicians do not talk such nonsense: at least I am unable to find any such absurdities in the "Encyclopaedia Brittanica." In one modern mathematical book I find the author rather undecided as to whether he shall talk such 4-dimension nonsense; but in spite of the fact that he is a reputable mathematician he concludes that such "*hypergeometry*" resulted when the mind of man "finally burst into flowers of its own"—a rather vague statement for a mathematician. But in sober moments competent mathematicians consider space to be the same as it is in our general equation—primarily a relationship word (Whitehead, in "Ency. Brit.," xi, 730). However, Whitehead frankly admits that mathematicians are undecided about it, just as his competent associate Russell admits in general that they are undecided about the One and Many ("Ency. Brit.," xvii, 881), which is really the problem under *space*.

g. It is obvious that because we tacitly call our Trinity

language "sense" or commonsense, in order to be consistent we must call any other language nonsense. And I did. But to repeat, that means *compared* with Trinity language.

h. Obviously, in each of those infinite forms of language with respect to the number of "dimensions" we may now have another infinite regress in sorts of space—Euclidian and non-Euclidian. That makes the total of mathematics or of language to consist of explicit statement of an infinite regress of languages of different extent of form, each of which languages in turn consists of an infinite regress of languages of different 'intensity' of form—which may be expressed:- *Extensity of forms...* × *Intensity of forms...*, exactly equivalent to *That...* × *This...*. There consequently can be no actual end to the mind's 'bursting into flowers.' I omit those "flowers" here, and with rigid parsimony use everyday Trinity language of Euclidian space. But we can see that the mathematicians can have an extensive flower garden.

§63. a. In the last section it was not stated just how we are going to represent those different kinds of spaces with our ring model. In this section I shall represent them by showing briefly some of the possible variations of the ring. To show those variations in detail would constitute a complete new mathematics—volumes of which are here omitted.

b. A symmetrical ring consisting of a geometrical single surface is generated when a straight line, the generatrix, is moved so that the same point of it lies always in the circumference of a directrix circle and its whole remains always in planes passing through the center of the circle and perpendicular to it, while at the same time the line rotates around the circumference as an axis at half the angular rate of its revolution about the center. In order to represent the unlimited possibilities of making non-Euclidian languages, that symmetrical ring can be varied from that symmetry indefinitely. Instead of a directrix *circle* we could use any closed path. And the 'warp' (the proportionality of its rotation about the directrix) may be varied locally in any degree, so long as the generatrix finishes a complete revolution with an algebraic sum total of 180°, or 180° plus any multiple of 360°. If the sum total of the twist is different from that, and the generatrix is of finite length, truistically the surface will not close as a single surface, with one revolution, and we have no 'language,' as there is no summed identical relationship. The language would be a *dualism*; and, any of the languages described in §62c would be represented by a ring in which the length of the directrix was zero, and the twist unstated. If the twist were stated, then other details too trivial and extensive for mention here are obvious.

c. An actual paper ring made of a straight strip will not take that symmetrical form, because to permit its doing so its edges would have to stretch and contract considerably. Also, when the generatrix explicitly has a length of line extending away from the directrix greater than the diameter of the directrix the single surface will intersect itself (and a ring made of a paper strip physically would not "intersect," but would "interfere"). That fact may be observed to be true by observing Fig. 63c, and considering what would happen if the ring were wider. (Fig. 63c is a perspective of a symmetrical one surface ring of appreciable thickness: it is shown cut square across by four arbitrary planes, so as to make it easier to see its shape.) If we had a paper ring of negligible thickness its width could be made as great as we like, without interference, by *folding* the strip first diagonally along its *length*, and again in other ways as may be necessary to keep the ZI and Z′I′ edges (Fig. 54) along the meeting edges of the finally be-folded triangle. The paper 'strip' then, when bent around to make a 'ring,' actually makes a cone. (It would require pages to express that construction with verbal explicitiness, and then it would not be easily intelligible. The reader, if interested, can readily understand the construction by actually making such a ring.) In whatever way the folds be made, there will be one or more thicknesses of paper between some portion of the 'joining' ZI and Z′I′ edges, and the joint will take various odd be-folded conditions. Clearly, as the meeting edges have the paper (or if that is considered of negligible thickness, then at least a "surface") between some portion of them, then in *ordinary* language they do *not* meet. But, by multiplying or duplicating means of stating relationships, an *n*-dimension language can be devised which will describe the be-folded 'ring' *as a "ring"*—i. e., *as if* the edges met: and hence as if the surface was *continuous* and "related."

d and e. Clearly, that sort of complicated language is not perceptibly needed in our ordinary life. The mathematicians may find uses for it, and quite likely in a century or so, after we get skilled in our Trinity language, the last paragraph may possibly be written in a consistent 4-dimension language and be easily intelligible in half its present length, instead of its being practically unintelligible as it stands in 3-dimension language unless such a strip be actually made. However, it is clear that there is not contained or involved in that 4-dimension model a "space" any different in a Many sense from 3-dimension, 2-dimension, etc. —— As an interesting fact, it may be observed that the model 'ring' which is now a cone contains all the relationships included in conic sections, and other branches of geometry—and those are thus here directly connected with the theory of logic. The volumes expressing that unified geometry are here omitted.

f. Instead of making the ring of a flat strip and neglecting its thickness, we may make a ring explicitly solid—say of square cross-section, as in Fig. 63f. In this case, instead of a twist of 180°, we give a twist of 90° (of 360° divided by the number of "surfaces" or sides the solid is considered

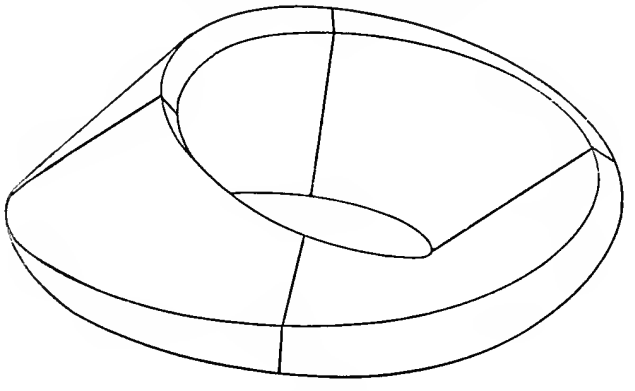


Fig. 63c.

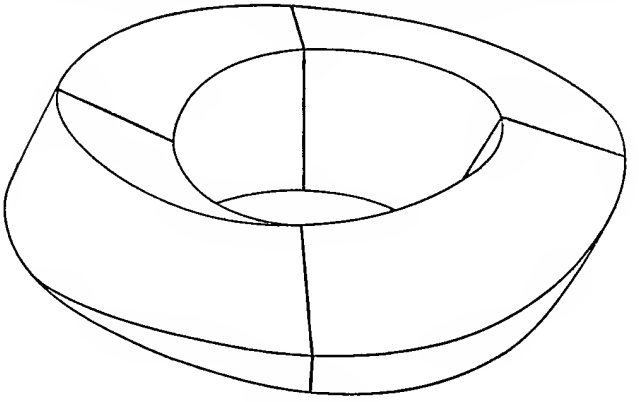


Fig. 63f.

to have). Then there is but one continuous surface, and one continuous edge; but we pass our finger *four* times around the directrix circle in completely following that surface. If we cut off a corner having a right triangular cross-section with legs of the same length and equal to half the ring's side, there results a ring of triangular cross-section four times the original length, with three surfaces and three edges, interlinked with a ring of the same sort as the original, but half the cross-section. Similar corners may theoretically be cut off the ring indefinitely, there remaining always a square core like the original. It is obvious that a *direct* description of the more complicated systems of relationship, Many surfaces, etc., of a symmetrical ring of this sort would require a Euclidian language of more than three "dimensions," or sets of reconciled contradictions.

g. A different language would be required for the *direct* description of a single surface ring made of triangular cross-section with twist of 120°. That is obviously so, if we consider the complications resulting if we considered the three sides extended indefinitely. Similarly, a special formal language is required if it is to be directly applicable to a ring of any regular polygon of n sides, with a twist of $360°/n$.

h. The *limit* of that regular n-sided polygon would be a *circle* of an "infinite number" of sides, giving a *tore* or anchor ring—or a smooth doughnut. If a "corner" be cut off that, it would be a line. And we would keep cutting it off, around and around an "infinite number" of times until the whole ring—or universe—was used up, and there was just one *closed* line to represent it. *All* the mutual contradictions possible (an infinite "number") would be used up and reconciled. The resulting line would be the Many, or the One, or (when considered as a twist) all of relationship. As a matter of rather obvious fact, the total *expression* in words would become infinitely formally self-contradictory—as is directly evident in this paragraph. Yet, because all those contradictions, and this line's implied "infinite dimensions" of "space" *mean* nothing more than *continuous*, we understand the description of that tore—the meaning of this paragraph—without difficulty. However, more or less concretely speaking, this paragraph is language gone mad. When we describe a common doughnut in this romantic way, we have passed beyond the power of the best mathematicians and used "∞-dimension space," and in that extraordinary language have in reality reverted to the language of the hen (§62c)—a concrete proof that infinity is logically equal to zero. There is not any difficulty about comprehending a doughnut. The universe is essentially as easy to understand.

i. One last point concerning this variable model of language remains to be added to make its infinite variety or variability obvious:- I have been calling language a machine. This ring also serves as a model of all mechanics, as we may briefly see:- If any of the rings (theoretically the 'cone ring' also; but we for brevity omit that) be revolved about its main axis (i. e., the line through the center of the directrix circle perpendicular to the plane of the circle: the directrix circle itself I name the *filiar axis*), then it acts as—is—a pump, or rotating fan, or propeller, of (and in) whatever medium surrounds it. (Hence, some useful machines might be made of the ring; I have not investigated those possibilities, but such an investigation may be worth while, especially when it is remembered that all "engines" are reversed pumps of various sorts, so that these rings will make a new sort of rotary engine.) —— Also, when the rings thus revolve, they appear to be rotating also in cross-section around their filiar axis or directrix circle; virtually or dynamically they are. Conseqently, they mechanically are *vortex whirls*, or "smoke rings." And in Part Two I use such whirls as being usually the most simple and convenient machine by which to describe the universe. A whirl is shown to be equivalent to a lever, or to any other machine (§100m). The universe, or any atom, or any natural machine (any 'artificial' machine *plus* man is shown to be a natural machine; §140), may by its use very conveniently and intelligibly be considered to be a sort of self-inclosed pump, or engine. Therefore, rigorously, language is as definitely a machine as is any other, and is as explicitly subject to "scientific" experiment and verification.

§64. a. Two general considerations remain to be added to our description of the concrete model of language:- In this section we take one:- that L and T always mutually imply each other. In the next section we consider the other:- the general method of splitting the ring into the Many.

b. We can observe in our model (as we have several times seen: §§36-7, 60i, etc.), that every time the idea or form *space* is introduced, it at least explicitly implies a cancelling *time*. I. e., space *and* time, as mutually contradictory words, constitute the relationship, or twist, in the model. To put it another way, the total universe can be described as the motion of the general ('universal') body M. We can not possibly have any *thing* which is not fully implied by 'M varying with V or L^1T^{-1},'—or with complete explicitness, by 'M varying with $L^\infty T^{-\infty}$.' We see directly from our model that in all cases of explicit expression, the exponents of L and T are equal and cancelling: in general are n and $-n$.

c. Physics, somewhat vaguely, terms those exponents "dimensions" (§68). But orthodox physics is not quite so definite about the matter as we are seeing is justified by the facts, and hence there exists no familiar way of stating the conclusion which is now obvious (also, cf. footnote 165b, on Bergson). That conclusion is, that, as L and T always imply each other, then if L is "curved," T also must be compensatingly "curved"; and if L is "steady" or "average" in ordinary average "space," then T also is average. —— Mathematicians and physicists are confused over the matter, although they substantially agree with that conclusion. Their esoteric way of agreeing is to use a form which is equivalent to making T a *fourth* dimension of L; obviously that makes T identical in form with L. They are not at all certain what it means ("Ency. Brit.," xi, 735). We come to the same thing in the theory of relativity (§66).

d. That last paragraph is not very clear—especially is it extremely confusing to follow the orthodox usage of T as a "fourth dimension." The last paragraph is one just for the technical objector. The simple facts we need to get out of it are (1) that L and T, whenever validly used explicitly, are paired; and (2) that all conventional technical languages are somewhat vague on this point (IX, §66), and consequently get into verbal confusions that are unintelligible if taken literally. E. g., Newton's law of gravity is such a confusion; strictly interpreted it is totally illogical, and precludes gravity's having any mechanics (Index, "Gravity").

§65. a. We have let our model represent the Many by having its Many surface divided *crosswise* (Fig. 54c). That has been convenient for the points of view we have taken. But if we had actually *cut* the ring into Many parts on those lines, the ring would have "come apart," and no longer have been a "ring" (unless we had considered it a One, in which "coming apart" has no particular meaning).

b. But we saw that the rings could have an edge or corner cut off, giving a lengthened ring of more than one surface (and edge), interlinked with a remaining single surface ring like the original, but with a diminished cross-section. Those split-off rings constitute units of the Many more definitely than do the 'crossways' units, for a number of obvious

reasons. In splitting off parts to get units of the Many, the relationship glaringly remains (as the interlinking); if a crossways unit of the Many had been cut out, we should have to consider that because the ring was the total universe then that cut-out unit of the Many could not have been removed "elsewhere"—so it *in effect* would stay in place and "preserve" the ring. —— It may also be observed that the split-off unit of the Many no longer has the characteristic of a continuous One and Many; the "logic" or language description of such a definite, formally separated but still interlinked unit essentially changes.

c. All those points have perhaps become so obvious that I shall write no more than those rough suggestions. A very extended discussion of them is readily apparent.

§66. a. In this section we consider the *theory of relativity*. We do so chiefly as a means of summarizing our ideas about language. For the theory of relativity is essentially a language or logic different from our ordinary Euclidian language, and a study of it will show how we may change from ours to a different sort. That theory of relativity, which is actually a new scientific logic, has been developed recently, beginning with a short article by Albert Einstein in 1905 which extended Lorentz's hypothesis of the Michelson-Morley experiment—an experiment which showed that there was no perceptible motion or "drift" of the ether relative to the earth, as indicated by the travel of light (see §127 for details), although the old dualistic theory of frictionless ether held that the earth could not drag that surrounding frictionless ether with it, so that there would be such drift (§127ij, XIII). —— For an authoritative statement of relativity I shall use Einstein's "Relativity" (Eng. trans., New York, 1920), referring in citations below to pages of that book.

b. Einstein used his theory a few years ago to predict the bending of the path of a ray of light in a "gravity field" (that bending is actually a special case of a general phenomenon of light known for centuries; §127). His prediction was reported verified at a meeting of the Royal Society in 1919 (ibid., 153-5). On that occasion J. J. Thomson, as its president, is reported to have stated in effect that those observations perhaps caused a revolution in science—the greatest in centuries, etc. And that rather strong language brought Einstein's theory into general prominence. However, Thomson is reported to have also stated that he could not understand the theory. (Obviously it is pertinent to inquire:- if he couldn't understand it, how could he guess it was a revolution?) But we shall see that the theory does not revolutionize science except in the sense that it expresses our commonsense science in a somewhat new and in an arbitrary language, which does not at all destroy or contradict or change our everyday language. Also, we shall see that there is no difficulty in understanding the essentials of the theory; and it is in *strict* principle impossible to derive, in a finite time, any definite *quantitative* result or statement from the theory. However, in practical use, guessing somewhat at quantities, the theory is sound and has great value, as we shall see. Einstein has done work that makes him the peer of Newton.

c. The *specific* essential of relativity is correctly and clearly stated by Einstein (ibid., 135):- "According to the general theory of relativity, the geometrical properties of space [*and* time: the rest of his book proves that space is logically inseparable from time; see par. g of this section] are not independent, but they are determined by matter." Hence, as he uses *matter* explicitly as "quantity," and as he shows that matter is always varying or changing quantitatively (that mass varies with velocity), therefore M, L, and T are always varying—or, Einstein has no formally steady language. Or, instead of having our Many member, $M(varying\ with)L^2T^{-2}$, in which L and T are arbitrarily and formally or logically fixed and steady as in our everyday language, and in which member there is a '*(varying with),*' or assertion of no possibility of a *quantitatively* exact science (see our next chapter, IX, for details), Einstein's theory of relativity would have a member in which there is no '*(varying with)*', but an *exact* quantitative science, although then formally L and T are *not* constant and steady or formally exact and unvarying. In other words, Einstein's theory is obviously logically precisely the reverse of our everyday *language*; in respect to *concrete facts*, or to assertions about matter, our language and his language obviously undertake to *mean* identically the same. —— As a truistic result of the fact that formally his L and T are not steady, Einstein's general relativity has a space (and time) which is not Euclidian. His space and time is a verbal "reference jelly-fish"—i. e., an unfixed, shaky, uncertain method of talking (his translator says "reference-mollusk," p. 117, etc.; but "reference jelly-fish" better expresses what was or should have been Einstein's idea). *And that relativity space has no fixed curvature* or definite variation from Euclidian space. (Truistically it can't have; for otherwise L and T would be unvarying, although with [Gaussian] numerical coefficients different from unity; see par. e.) Consequently, it is in strict principle truistically impossible to get any definite quantitative result or statement from the theory. —— Einstein (p. 136) concludes that our universe is a more or less (i. e., numerically unspecifiably) spherical or elliptical non-Euclidian space—thus showing that in his own hands in the end the theory can give no definite quantities. And incidentally, as we saw (§62), that more or less bounded or shaped relativity space *means* precisely the same thing as our ordinary language's infinite or unbounded space of the universe; for obviously there is nothing but an unessential verbal difference between a universe which is unboundable and an "infinite" one.

d. Or, we can express the last paragraph, showing the essential characteristic of the theory of relativity, in a more intelligible and more general way:- Einstein in actual effect says that he will express everything in a *quantitative* form—will express everything in *exact* measures—will have all statements in the form of *exact* quantitative *science*. (In short, he *in effect* asserts that there will be, for his theory, no difference between *qualitative* and *quantitative*; he can be noted asserting that in his first complete paragraph on p. 23, and the second on p. 15. And in agreement with my assertion that he verbally makes the two equivalent, on his p. 98 he in effect consistently and properly rejects the problem of the One and Many as being non-existent—or the One is directly the Many—in the next to the last sentence in the first paragraph.) Such expression of everything is in principle an absolute *quantitative* unification of all knowledge. And we have seen (§40, etc.) that such a quantitative unification is impossible. But Einstein consistently and validly makes merely a *formal* unification of that sort *except that he does not finish* (strictly, a unification of that sort would have to run to infinity). I. e., in actual effect, as we have already seen and will see more explicitly in the next paragraph, he gets a jelly-fish or variable frame of numerical translation or expression or "reference," so that although *formally* he has a quantitative unification, actually he has to guess at quantities just as we do in ordinary language—which is merely another way of saying that he does not finish. Consequently, Einstein has a language which is formally the opposite of ours; but as stated, it means the same as ours, and there is no real conflict. We take it that our standards of measurement are formally steady, but that in the nature of things we can't

accurately measure always varying matter; Einstein takes it that his standards measure matter accurately, but that the standards themselves always vary, and vary in an unmeasurable degree.

e. Or, we can express the general relativity theory in specific mathematical terms, thus repeating the last two paragraphs in another form:- Einstein does it excellently (p. 115):- "The following statement corresponds to the fundamental idea of the general principle of relativity: '*All Gaussian co-ordinate systems* [of which the Euclidian "system" is a special, or more precisely, a limiting, case] *are essentially equivalent for the formulation of the general laws of nature.*'" I. e., *all* events or phenomena may be quantitatively expressed by *exact* symbols *in a certain kind* of always practically non-Euclidian space and time. Einstein proves that. Then, the mathematical formula for expressing one phenomenon in terms of any other is worked out (p. 105) to be:- $ds^2=g_{11}dx_1^2+2g_{12}dx_1dx_2\ldots+g_{44}dx_4^2$, where *ds* is the quantitative difference of the two phenomena, the *x*'s are really our ordinary Euclidian time and dimensions of space, and the *g*'s are numerical coefficients for the given particular case, which fix *for that case* the variations of the time and space from the Euclidian reference or *limit.* In brief, that expression is simply in effect equivalent to our formula $M(varying\ with)L^2T^{-2}=The\ One$ (but is not precise as to what is the One and what the Many expression; see par. h). *But*, it immediately follows (ibid., 106), from the way that Einstein derived that formula, that the magnitudes or coefficients *g* have values which *vary* with each event. Consequently, in actual effect, that Gaussian or non-Euclidian formula is *not* mutually translatable from one event to another; it is only formally or unintelligibly-orthodoxly-mathemathically translatable—the monstrous word fits the case. Or, as before, the relativity or unification derived by Einstein is merely *formal*—is actually qualitative, just as the one we are deriving in ordinary language is.

f. It therefore is truistic with those three ways of viewing relationships (in the last three paragraphs):- (1) that Einstein's general theory is right (he has worked out an extended formal truism, mostly in terms of the orthodox mathematics of space and time); and (2) that his form of using words is the reverse of our ordinary way (and is hence rather novel and sometimes puzzling—especially to him). Our ordinary language is a language which, although explicitly inexact as to quantity or measures of sizes of things, is *qualitatively* or essentially the same language for all of us, and for all time (except for the arbitrary practical fact that from time to time we mutually agree to change the application of certain words, or invent new ones). The backwards language of the relativitists is theoretically exact as to quantity, but essentially is, or requires, a different language for each person (as each person is a different phenomenon or event—is differently located: two persons can not occupy the same space), and also must be varied by each person from moment to moment into a new language (as we saw, especially in considering the Gaussian formula in the last paragraph). A simple example of that would be:- If we use the theory of relativity consistently, with reference (say) to what we in our ordinary language call "*a boy*" (all of us admitting that "*a boy*" does not mean *exactly* quantitatively the same to each of us), then only at one instant in eternal time and then for one observer only, at one zero or point spot in infinite space (and actually, no observer can occupy a *point*), would the name "*a boy*" *properly* apply, and hence be a permissible relativity term. All other observers, and this single point-observer at all other times, in order to use relativity consistently, must invent and use a new name (a different "quantity"); he could still use the exact numerical form "*a* ——" (the "*a*" meaning *exactly* 1), but must fill in the blank with some new word to or with which the quantitatively exact *a* or 1 will fit—which new word would itself be good only instantaneously. —— Obviously, relativitists can't *practically* consistently talk any such language. What Einstein actually does in practice, even in his formal book, is *tacitly* to use our ordinary Euclidian language as a means of translating. E. g., in the last paragraph we saw that his unifying formula was itself actually expressed in Euclidian language.

g. It will be useful to notice two particular points about Einstein's theory in this long paragraph. —— (1) He states it as two theories, a *special* theory of relativity, and a *general* theory (his special theory really deals with what we call the One, and the general with the Many, as we see shortly). In the special theory he works out the verbal method for expressing phenomena in mutual terms of two bodies which are moving relatively to each other in a straight line, with constant motion. He uses the velocity of light as a standard of comparison (i. e., a verbally *constant* velocity in "free" space), thus tacitly using Euclidian space and time as the form of talk to measure that velocity (which is what we call a *qualitative* base). But Einstein sees, as we we shall see, that motion in a straight line at constant velocity is a special limit, and experimentally can't happen in the real universe (§§83, 88, etc.). Therefore, he had to develop what he calls the general theory of relativity, which will apply to actual variable motion (for all the details of such motion see Part Two). But as soon as motion departs from a straight line, the standard of measurement (the speed of light) is truistically *relatively* "curved" (the paths of both bodies considered are relatively curved), and hence *variable* in quantity—i. e., *merely as a verbal truism* of such language agreements, and without any reference to what actual light does do, light can no longer in such language, verbally travel in straight lines at constant speed. Hence, as can be seen, *all* possibility of comparative measures of two mutually variably moving bodies (and all actual bodies are such) has departed from Einstein's logic; or, that logic or language necessarily or truistically reverts to the jelly-fish system of reference for both space and time, as before seen. Einstein seems to think he shows that change from special to general theory by experimental facts—talking about "gravity field" at some length,—but as a matter of fact, his gravity field is created (and 'described') by an extra-universe, inconceivable God and is piffle, and Einstein is actually merely formulating verbal agreements—and doing a good job at that. The only actual experience he is using is the observation that, expressed in ordinary language, mass varies with velocity. He is unconsciously making his forms fit that Euclidian fact. In short, it thus appears that the relativity theory essentially is logic or "philosophy," and not concrete or experimental science: compare it with Part Two of this book which *is* directly experimental science. —— With constant light velocity in one theory, and variable light velocity in the other theory, it superficially looks as if he were dealing loosely with facts. But he is not; in making the step from the special to the general theory he is merely shifting from Euclidian to non-Euclidian space, and reverses language (shifts from monism or monotheism as "reality" to infinite pluralism as "reality"). As a matter of strict fact, he could be said to have already done that with mathematical orthodoxy in the *special* theory (i. e., to have asserted both theories simultaneously according to the forms of orthodox mathematics). For in deriving the equations for talking mutually of two bodies (ibid., 139-45: those are the

equations Lorentz used in considering the Michelson-Morley experiment; for comment on them in actual physical terms, instead of terms of logic which are being given here to accord with Einstein's discussion, see §127j), in equations (3) and (4)—not quoted here, as they are not needed,—he multiplied zero by two "constants," and in effect said that the two could be *any* numbers. That is equivalent to saying that any number is equal to any other number, and accepts or uses the total orthodox forms of mathematics (§44). Conseqently, by that theory his "constant" speed of light in the special theory is already in general *any* speed—i. e., by such orthodox mathematics is variable. In short, his theory merely amounts to using a formal mathematics in which any number can equal any other number, as we saw was the case with ordinary orthodox mathematics. (Or, as we can see now, his *special* theory is what I call the One, and his *general* theory is the Many; his special theory is the *limit*, or the use of Euclidian space, or a dealing with 0 and ∞; his mathematical formula includes *both* the special and general, just as does orthodox mathematics, by considering 0 and ∞ to be numbers, and not *limits*.) That can be validly and logically done, merely by formally arbitrarily agreeing to do it, provided it is not otherwise contradicted, although as shown before in several other ways no definite quantitative statement which is mutually intelligible can then be made—there will be merely mathematical, symbolical, formal exactness or quantitative definiteness (and because by agreement no mathematical Many symbol need be definite anyway—i. e., *n* boys are not actually a definite number, although *n* is mathematically or symbolically definite,—therefore obviously it is possible to put that indefinite, not mutually understandable theory into mathematics and make it thus *indefinitely* understandable: that is the logical trick that can be done with mathematics, and it is highly useful provided the mathematician is not so soft headed as to fancy that just such formal, actually unintelligible statement is the end of the matter). Then Einstein, instead of saying bluntly and clearly that in his theory no number is steady, says what amounts to precisely the same thing:- that space (and time) is variable (an uncertain, shaking jelly-fish); and in practice he uses abstract mathematics, in which indefinite letters (such as *g* in par. e) are used for numbers, so that he talks mathematically about his theory without being actually troubled by that numerical indefiniteness. —— (2) The second point is that when he insists, following the mathematician Minkowski, that time is a fourth "dimension" of his jelly-fish "world," he means merely the same commonplace thing which we have been seeing:- that space and time must, in any valid logic, always be used together (and we see the psychology of that in §150e, etc.). Orthodox physics and mathematics drop time or *T* whenever they think it convenient or "simpler"; and that separation gives a dualism or materialism, as we have seen. And Einstein is merely destroying such self-contradictory materialism when he says time is a "fourth dimension"—as is quite plain in his book. He is not using "*dimension*" in the same sense that we speak of a "dimension" of space; in that sense the word is quantitative, as we have seen. When Einstien says time is a fourth "dimension" he simply means that it is a relationship word and ought not to be dropped, which is quite true: and he uses a very emphatic mathematical device to stop the dropping of time by mathematicians.

h. It thus appears that the relativitists have worked out a formal logic or "philosophy" in terms of scientific "exact quantities" or "matter." The "quantities" really evaporate, so to speak, or turn into unstatable jelly-fish measures; so the logic is actually the same in meaning and also in its *ultimate* form as ours. The theory of relativity is generally a revival of Heraclitus the Obscure's philosophy, as before noted—and is superficially obscure because it claims to be using (quantitative) terms which in practical effect it isn't using. Or, as was seen, formally relativity deliberately refuses to distinguish between *quantitative* and *qualitative*; naturally, as we commonly explicitly distinguish between the two, it is verbally confusing to us at first to use such a run-together language, where any number is openly and consistently asserted to be any other number or to be no number at all (i. e., to be 0 or ∞). —— *Relativity* really means unification. And Einstein's theory—or actually logic—is *in principle* incomplete in that he omits showing explicitly that all relativity or relationship is ultimately that of identity or unity (§28h). Also, his verbalisms are so confusing that many obvious conclusions and experiences are hidden from him; those are given in this book, in ordinary terms, with an occasional indication of how they would be expressed in relativity logic.

i. The theory of relativity is important, and has attracted much attention, because it is a unification of knowledge and is valid. Einstein makes a number of minor logical errors in his book. But he drops those slight errors and pulls through triumphantly with a formally valid logic—valid so long as he keeps his infinite regresses and actual numerical indefiniteness summed into that jelly-fish space, which miraculously quivers infinitely (but merely verbally). About the only theoretical objection to his work worth mentioning is that he seems to think that his non-Euclidian remarks may be "real" and different in actual meaning from our ordinary way of talking. But *because their phraseology is so novel, the relativitists are not bothered with any of the superstitions of the old dualistic science, and hence go along unhindered and discover many new principles and facts hidden by and to that materialism.* Hence, the very novelty and quantitative verbal unintelligibility of its verbalisms which repel and puzzle, are the characteristics of relativity which make it valuable now to the scientist by making him forget the materialistic superstitions of the old so-called science. As evidence of that, already it is reported that the German materialists are attacking Einstein, but doing it on other alleged grounds. The reader who does not intend to become an expert scientist need not bother with relativity: if the relativitists discover any new "fact" that is actually a fact they can state it, even for themselves, much more clearly than in relativity terms, in ordinary terms intelligible to the average reader.

CHAPTER IX. *Theory of language in terms of Physical Science; or, general unification of "science."*

§67. a. In this chapter will be shown the general unification of knowledge in terms of conventional physical "measurements," or experiments. I shall state more definitely what that means:- All our *positive* language is based upon explicit, or tacitly accepted, measures—is expressed in positive Many terms by means of using relationships, which are the "measures." Thus, we speak constantly of a foot, acre, quart, pound, meter, much, little, now, yesterday. Even in the so-called "spiritual" business of (say) getting a wife (or husband) we tacitly use measures:- e. g., we ordinarily would not accept a spouse who was two feet or ten feet tall, who weighed a ton, or who in mental measures was "unbalanced." In short, our *definite* thought and talk is explicitly in Many terms—involving either directly or with but slight indirectness *L* and *T*, or some of the numerous practical synonyms of those relationship terms. We talk and think,

in so far as we do it positively and with perceptible usefulness (cf. §§166, 168), in terms or "measures" of the first two members of our equation, *That*... × *This*... and *M*(*varying with*)L^2T^{-2}, and have a *meaning* that is the One or religion tautologically named by the third member. In a general way, physics (or "natural science") is the broad outline statement of such terms or measures made with respect to what we call "objective" or "material" things (for more specific description of *physics* and *science*, see §§85-6). Those terms are the easiest to use: when we learn to use them, then we are more or less competent to use "subjective" or "spiritual" terms in Part Three. Hence, *physics* is simply the actual *use* of our logic or consistent language, in connection with the simplest or least complicated Many parts (those that are superficially that way, to be quite accurate: all Many parts ultimately are identical in complication). —— We may have a very fine, theoretically valid language; but if we do not *use* it, apply it considerably to ourselves and our environment, it is doing us no particular good. Physics *uses* our logic mostly on the "environment"—that being easier to see *definitely* than ourselves. The general physics of this chapter is therefore a rough, broad application of what we have observed in this Part One. And it is a self-conscious, broadly complete application, so that we may see *how* it is done, and thus be able to understand our language and use it ourselves for facts of direct interest to us. Physics themselves are ordinarily of slight *direct* interest to us: just "pure" physical statistics bore me dreadfully. But as "clues" that enable us to derive the complete detective story of the universe, physics are quite entertaining. As we are going to find out what "measures" are, mostly this chapter is the explicit general application of *M*(*varying with*)L^2T^{-2}.

b. Hence, all of us who use language have some practical need for this chapter. However, in it I am going to unify *all* things, in general explicitness, so that there may be no question as to the rigorousness and applicability of our logic, even in the minds of experts. Probably no reader, not even the physical expert, happens to be familiar with and directly interested in all the things which I happen to have looked up and to have mentioned in this chapter. Consequently, parts of it will be decidedly hard reading—rather dull and dry. There is no practical way of avoiding that: everything that is worth having costs some effort. However, the reader can merely casually scan such parts, verifying for himself only the passages that interest him and seem to be of use to him, and (unless he is a professional scientist) he will miss a negligible amount. This is much the "hardest" and dullest chapter in the book.

§68. a. Orthodox scientists in effect undertake to make a consistent theory of language or logic, naming the result the *theory of dimensions*. For details of it, see any fairly full physics; for the few details we need here I use "Ency. Brit.," Art. "Units, Dimensions of"; Watson's "Physics" (see Appendix A), pp. 6-9; Daniell's "Physics," pp. 15-16, 746, 748. That conventional theory of dimensions, or logic in terms of physics, is correct in principle so far as it goes: it merely is incomplete, and hence gets into confusion with some details.

b. Watson's "Physics" explicitly states that a "dimension" is a relationship, thus:- "The relation by means of which we derive the magnitude of the unit of any quantity, in terms of the fundamental units, is indicated by what is called the *dimensions* of the unit in question." The fundamental units are *M*, *L*, and *T*. To give an example of that rather vague conventional definition of *dimensions*:- If we write $[V]=[M^0L^1T^{-1}]$, it means that a unit of velocity $[V]$ is equal to an agreed-upon unit length, divided by an agreed-upon unit time (i. e., multiplied by $[T^{-1}]$), with the agreed-upon unit of mass equally applicable to *all* (∞) cases, or from the 0 point of view, *not explicitly* involved (i. e., $M^0=M/M=M^{1-1}=1$). And that equation $[V]=[M^0L^1L^{-1}]$ is a dimensional equation. The dimensions of *V* are said to be 0, 1, and —1; or more fully, so as to be completely explicit, the dimensions of *V* are $[M^0L^1T^{-1}]$. It is formally truistic therefore that if a velocity is ever mentioned by physics the explicit or full expression of it must involve just those dimensions and none other. And orthodox texts correctly generalize that into the principle that in any physical equation which is valid or consistent the dimensions of each member are the same (Watson's "Physics," 790; "Ency. Brit.," xxvii, 737). Obviously, that actually is equivalent to our principle that the logical proof of anything consists of reducing it to truisms (§35); so fundamentally, orthodox physics is obviously directly our 'language' or 'logic.'

c. A paragraph of arbitrary detail is required here. Ordinarily physics (as opposed to the theory of relativity) regards the [*M*], etc., as being an agreed-upon unit, fixed and constant, just as are the verbal forms of this book. Then, when (1) various parts of the universe are expressed in terms of that unit, or when (2) a *given* actual part of the universe varies in different circumstances, the *same* arbitrary unit is used for measuring (i. e., *naming*), *and* a *numerical coefficient* added, which indicates (1) those different parts, and (2) those changes. When ordinary physics is explicit, it usually uses a small letter for that "numerical coefficient" or *number* or "measure":- thus *m*[*M*] means (say) 3*M*, or 3 grams. Precisely the same agreements are used in everyday language. Thus, as we have seen (§§60hi, 66fg), if we say 'boy,' the expression is equivalent to [*M*]; and we say 'John, a boy,' 'big boy,' 'five year old boy,' etc., in which the added words or phrases are equivalent to a *number*, or general name or measure, or *numerical coefficient m*—and '*boy*' stays "steady" or "constant," or an agreed-upon *verbal* unit of the Many like the *form* [*M*]. —— In this book our fundamental principle that we shall keep the three sorts of words unconfused is itself equivalent to saying that our fundamental equation *That*... × *This*... = *M*(*varying with*)L^2T^{-2} = *Universe or Energy* is *a dimensional equation* in which (1) the dots ... and the '(*varying with*)' are symbols which are precisely equivalent to those numerical coefficients (as we shall see throughout the chapter;—and it is to be noted that in our equation we always not only *express* the existence of those coefficients, but also indicate their *variable* character); and in which (2) our *M*, *L*, and *T* are the dimensional units conventionally printed with the brackets around them; and in which lastly (3) the *That* and *This* (without the dots) are equivalent to such conventional dimensional quantities as [*V*] (i. e., *That* and *This*, and all names in physics such as *V*, are *not* complete and *explicit* expressions, but are *irrational* as more fully defined in §71g). —— Therefore, because the method of speech we are using is already explicitly what physics calls dimensional, we do not need to distinguish such equations by putting the quantities in brackets. Also, as we see throughout this chapter (cf. also §§134, 136, 138, etc.), orthodox physics uses terms (such as *K* and *U*; Index, "*K*" and "*U*") which are *not* dimensional although orthodoxly more or less taken to be so, but are numerical coefficients. So if we were to use such brackets in this book, it would not be possible to use them in a conventional way, because of that orthodox confusion, and also because of the fact that *M* is not the same sort of formal word that *L* and *T* are, and the brackets conventionally used would tend to imply that it is. Obviously, the brackets used by physics indicate a vague and perhaps even conscious yearning to have relationship

terms always distinguished formally from Many names (cf. §§62f, 44). Hence, I omit those brackets hereafter, and will gradually clear up that double confusion that exists in conventional physics, as it becomes intelligible to do so.

d. Now, from our investigation of language we have in effect seen:- (1) that all complete sentences are dimensional equations; (2) that such valid sentences have the *same* dimensions in each member; (3) that finally such dimensions really sum to zero (or ∞); (4) and hence all valid sentences are ultimately truisms of the form $A=A$; and (5) therefore all *verbal* "proofs" reduce to that truistic form *as being the proof.* That is the summary of Part One in terms of physics or physical equations. In detail it obviously means this:- The first member of the general equation is *That*...×*This*..., which, fully expressed, is $(That \times This)ML^{\infty}T^{-\infty}$—and that form permits the tautological (*That*×*This*) to be dropped if we like, so that we have the *Many* unit M, with actual "dimensions" or relationships that are $\infty-\infty$, or 0 (and the M *itself*, taking it directly, is *all* things, or from that point of view has ∞ dimensions). The second member, $M(varying\ with)L^2T^{-2}$, is similarly one in which the actual dimensions are always 2—2, or $\infty-\infty$, etc., or zero—leaving again the Many name M. The third member, *Universe* or *Meaning* or *Energy*, obviously contains no real dimensions (or ∞ dimensions from the other view), or has zero "dimensions," and simply implies that it may be arbitrarily divided into M's if we like. So we really have the truism, in *physical* terms, $M=M=M$: or, more explicitly, as one M implies others:- *All M's=All M's=All M's, and all M's are unified or connected.* In that equation M is not a "dimension" or relationship term (but from the other point of view it explicitly implies infinite relationship; the relationship terms can not properly be dropped from *positive* language; the *definite* equation obviously should be $M...=M...=M...$, where ... indicate the dimensions, thus become symbolically infinite).

e. Now, the orthodox theory of dimensions does not precisely assert the last paragraph. But I think it is obvious that the conventional theory of dimensions has been striving to say just that paragraph—and very clearly means it. Therefore, in brief, our investigation of language is nothing more than a series of observations of commonplaces, which gives us the same speech or "logic" that physical science uses and formally names "theory of dimensions." By going at that theory in terms of everyday life, we saw definitely its completion, and meaning.

f. We need to look at the physics method of speech from one more aspect:- I must again anticipate the proof (§§88, 83, 100, etc.), and assert that we observe different things (split the universe into M's) by noting their "surfaces" or bounding zones, which are at about the conventional "velocity of light." (I. e., we in practice divide or split a chair from the rest of the universe because various outside layers of what we call the chair send "light" to our eyes, or quantitatively similarly affect other nerves; if we "set fire to the chair" those velocities change enough to modify our splittings considerably.) The completest theory in orthodox physics is electricity (XIV). That theory uses two names, K and U (which, with respect to electricity, mean respectively the same that *visibility* and *transparence*, and somewhat synonymous words, mean with respect to light). K and U are used to give the measures of electrical M's. Orthodoxly, they are nominally dimensions, although it is frankly asserted by competent physicists that their nature is unknown (Watson's "Physics," 789). But by ordinary experiments physicists find that K and U together directly assert the velocity of light. That is to say, all electrical M's or parts of the Many are also distinguished or split from the rest of the universe (or "measured"—*distinguished* and *observed* and *separated into parts* and *considered different*, and all such terms, are simply synonyms of the formal technical term *measured*)—all electrical M's are also, like a chair, distinguished by what is ultimately the average velocity of light in their neighborhood. And there are names or 'measures' exactly analogous to K and U in all phenomena. So it perhaps is now generally obvious to the reader that K and U, and the other similar terms, are identical in meaning (but *explicit* in what we might call *quantity* of meaning) with our '(*varying with*).' I. e., they are numerical coefficients which merely designate *which* actual M it is we are naming by means of the fixed standard *form*, M—regardless of what "sort" of "phenomenon" we are talking about. They indicate that we mean the 'boy K' or the 'boy John' or even 'the boy *matter* that has now grown into the man *light*' when we name a 'boy' in certain circumstances—i. e., in certain "phenomena."

g. Well; that is the total theory or "inwardness" of physical science, and the explicit statement of the solution of the only general unsolved "problem" in orthodox science. It is no problem; to repeat, competent physicists know that its non-solution is a verbal confusion, and hence is merely an incompleteness. The theory of physics is hence very simple; anybody not mentally defective can understand that all it is, is a very carefully explicit naming of all its 'boys'—of all its M's regardless of what clothes or even "disguises" they wear, of what changes in appearances (dignifiedly called "transformations") they pass through. The *method* or way of doing that naming is precisely the way we use daily in talking about different 'boys'; the physicists call it by the large name "theory of dimensions," but there is no reason to fear a cow even if it be referred to as a bos taurus.

h. Consequently, physics merely applies the theory of language we have seen, (1) using four or five sets of "technical terms" instead of the set *That*...×*This*... (there is a set for electricity, one for heat, etc.), and (2) getting definite numbers, measures, or names for the general '(*varying with*)' in the second member. We saw in the last chapter that we can make models of language and thus make language more intelligible to us. In the same way we can make models or "machines" or mechanical theories of the particular expressions of physics, and make physics more intelligible. Part Two is for that: in this chapter we take just the general language of physics.

i. And we see again (cf. §67b) that this chapter will not be quite familiar, and hence will be hard reading in places. We now see definitely that part of that results because of the confusion which is in orthodox science. The fact is that I personally derived the theory of language by definitely starting with orthodox physical equations and eliminating their inconsistencies. But by actual experience I have found that that directly "scientific" way of unifying science is so deadly dull, especially to professional scientists, that people would rarely read it, and could not keep their minds on it long enough to comprehend it when they did read it. They can't see at first just what it is "good for." It actually is highly useful, and some parts of it are likely to be of interest to the general reader. It is useful because it shows explicitly the general way of making all positive statements (that being the base of science, engineering, etc.)—and is brief enough to be grasped in a lump, especially as I have so violently condensed the chapter. But there is no particular reason why the reader who is not directly interested in the special facts to be noticed should make an effort to remember them.

§69. a. In this book I shall use for the most part the

conventional physical symbols, as given in "Ency. Brit.," xxvii, 736-45, and Watson's "Physics," 7f, 343f, 789f, adding subscripts $_r$, $_e$, or dots ..., or coefficients to them when necessary to distinguish explicitly the three parts of the Trinity, and substituting English for two Greek letters —there being objections to lugging in Greek if English will serve. The orthodox fundamental equations are of course supposed to be simply a shorthand way of stating the results of different sorts of systematic measurements—of *explicit naming*. I take it for granted that the reader is roughly aware of how those experiments or measures are made. In the end, of course, *all* measurements, *all* observations, consist in observing space (and time) coincidences (or negatively, lack of coincidences); e. g., noting that the top of one boy's head will reach to the same mark as that of another boy's—all that being a mere truism of what we have already seen about language. But if it happens that in any case where I omit statement of details the reader is not roughly familiar with the orthodox experiments he can find descriptions of them in any fairly full physics or encyclopedia.

b. And in this book, unless otherwise specified by the context, we shall use the ordinary scientific units:- M is the unit representing the mass or quantity (§§70-4) of a portion of matter which weighs a gram at a given place, under given conditions (including date, or T). L is the unit of space, a centimeter, which is the 1/100 part of the distance under certain conditions (including date) between certain marks on a metal bar—kept in Paris, I believe. T is the unit of time, a second, which is the 1/86,400 part of an *average* solar day of the present. The average solar day varies, so we do not know exactly how long a second is, any more than we know exactly the unit M and unit L.

§70. a. Conventionally, $W=Mg$; or weight W of a a body M is equal to the mass M of the body multiplied by the number g, which number names or measures the acceleration given the body by the force of gravity acting at a certain place under certain conditions, as observed by experiments. (Incidentally, under average conditions in temperate latitudes at sea level on earth, g is approximately 981cm/sec^2, or 32ft/sec^2.) That equation is a numerical or non-dimensional one. W is (conventionally: all this is orthodox, as stated) the force of gravity at a given place and time. Acceleration is the change in velocity during a unit time, or is equal to V/T; $V=LT^{-1}$, and hence *Acceleration*$=LT^{-1}/T=LT^{-2}$. Hence, the dimensional form of the equation for W is $F(qf\ gravity)=MLT^{-2}$. Conventionally, any unit F is equal to, or measured by, the fact that it *results* in giving unit mass a unit acceleration; i. e., if we push with a certain "force" on a ball, the ball will roll faster and faster if "free" to move, *under average conditions*. Or, as the brief way of saying that:- $F=MLT^{-2}$. And orthodoxly, energy is force-acting-through-space (the *amount* of the results of force); or *Energy*$=F\times L=MLT^{-2}\times L=ML^2T^{-2}$. Now, orthodoxly, Newton's law of gravity (usually I shall refer to it simply as 'Newton's law') asserts that every body M in the universe attracts every other body M' with a force F that varies in each case directly as the two attracting masses and inversely as the square of the distance L between them. If we take all three as being units, we may condense Newton's law to the dimensional equation, $F(qf\ gravity)=M^2L^{-2}$.

b. Therefore, we have by orthodox physics two equations for F when it is a certain kind of force (the force of gravity):- $F(qf\ gravity)=MLT^{-2}$, and $F(qf\ gravity)=M^2T^{-2}$. Consequently, if we stick to our fundamental agreement $A=A$, or to the conventional axiom that things equal to the same thing are equal to each other, then orthodoxly the two F's are equal, and we have $MLT^{-2}=M^2L^{-2}$. From that, by algebra, $T^{-2}=ML^{-3}$; or (1) $T^2=M^{-1}L^3$; or (2) $M=L^3T^{-2}$; or (3) $L^3=MT^2$. Obviously, any of those three formulas, explicitly interpreted, is sheer nonsense. The first asserts that a time, squared, is equal to a solid space divided by a body; the second, that a body is a solid space divided by a time, squared; the third, that a solid space is a body multiplied by a time, squared—all mutually contradictory nonsense, and all violating the orthodox principle that the dimensions on the two sides should be the same (§68b). Orthodox science has for years recognized that such a nonsensical self-contradiction existed at its very base or beginning.

c. It immediately follows, that (1) the orthodox definition of F is wrong; or (2) the orthodox law of gravity is wrong; or (3) both are wrong. We find that both are wrong (§74d). That is to say, in defining or writing both of them, conventional science simply failed to note and express explicitly all that was actually observed. The difficulty with both is that too much is left to implication—i. e., orthodox science in them gives no indication as to which of the three sorts of words is being used, and mixes them. Science now actually knows the *facts* quite well; but there is so much of the *expression* of those facts omitted in the equations for F, W, and $F(qf\ gravity)$ that as soon as the equations are compared (to see if science keeps on sticking to $A=A$), explicit nonsense results. Hence, what we have to do now is to *observe* just what is meant, and say it explicitly.

d. The truth of the matter is that F and W *in the equations* are not the same, and ought not to have been equated. F is a general way of considering a *part* of the expression for *Energy* (and *only* the *total* expression of it is intelligible and verbally consistent, anyway; §71g); and W is *another sort* of part of that expression for *Energy*. But there is nothing in orthodox physics which explicitly asserts that about those equations, or which in any way explicitly holds that what I did in par. b is not permissible (I merely did with orthodox physics what I did in §44 with orthodox mathematics)—except of course it is recognized that such nonsense would result, and so conventional physics usually stops before it writes those queer equations—keeps its skeletons decorously in the closet.

§71. a. In the first place we can observe that physics undertakes to use F or force itself simultaneously as a Many word and as a relationship word—and then later on uses it as a standard One. Thus in Newton's law, $F=MM'/L^2$, F expresses a *relationship* between two bodies M and M', and is identical in real meaning with cohesion or love (§88), or God the Holy Ghost. But in the orthodox equation $F\times L=ML^2T^{-2}=Energy$, F is actually an M, a part of the universe, or a Many word (just as in *That*...$\times$*This*..., *That*... implies an M, or is a Many word; §36l). And in the orthodox equation $F=MLT^{-2}$, F is substantially a One word, as it is absolutely alone. (As a matter of fact [cf. par. g], all of these orthodox equations are logically mystic—i. e., *all* their symbols are more or less One words. The assignment just made of orthodox F's as various sorts of words is based on the point of view developed by this book.)

b. The simplest way in which we can use the conventional F, and other symbols, and at the same time keep our thought clear and definite (i. e., avoid the classic-logic or dualistic mysticism just mentioned), and thus arrive at valid conclusions by following the logical rule (§§43-4), is to distinguish its three uses in the Trinity by three *explicit modifications*. For such three uses, I shall use two subscripts, $_r$ and $_e$, and the dots ... *or* a numerical coefficient (C, G, K, U, H, J, etc.) that is equivalent to the dots. The subscript

$_r$ means that the symbol it is used with is a relationship word—equivalent to $\times$, $\div$, $=$, etc. The subscript $_e$ means a zero (or infinity) or One word—usually a standard unit or One. (The $_r$ is the initial letter of *relationship*; I couldn't buy the type for a letter more suitable than $_e$ except at a silly price, so I use $_e$, which can be remembered by the fact that it looks somewhat like a little zero.) Our symbol M standing just alone (and also, formally, all the M's used in orthodox science) is *a standard* unit or One; i. e., *at a certain time and place* it is taken as a *fixed* standard, and it is then logically or formally considered to remain so *as a word*, and always to refer back to those *formally* absolute conditions (cf. §68c). Consequently, as an M, or other symbol, standing alone *formally* (i. e., without any dots, or coefficient, or subscript $_r$) is thus formally indicated to be such a standard, there actually is no positive need to distinguish it by the subscript $_e$; but often hereafter, as a means of typographically emphasizing its standard nature, I use the subscript. Then, a symbol followed by the dots, or by a 'coefficient' (§72), or by its general equivalent '*(varying with),*' is a *That...*, a Many word; examples:- $M...$, MC, $F...$. —— Further, as there are different "sorts" of force (i. e., conventionally, but not at all necessarily, a force is named with various names to indicate "different" phenomena), etc., when it is convenient and clearer thus to name them, I add either the subscript $_s$, meaning a "static" phenomenon, or $_m$, meaning a "dynamic" one, and at times further add, in parentheses, the name of the phenomenon.

c. Now, if we wish to *name* at least two M's, in order that *later on* we may *say something* about them, clearly we must assert that there *are* such two parts of the universe, with a relationship F_r. That is *positively all* that F_r is—a pure *verbal* assumption or *agreement*, serving as a verbal basis of *then* making an intelligible statement. *Then*, if we assert that the M's related by the F_r *do* move relatively to each other, there has been a *That...* or $M...$ or $F...$ (i. e., an M asserted related) which is compared with the *This...* which is-are the other M's (any motion of *one* M, except in the case of an abstract unit or standard, which only exists as a verbal form, changes it to $M...$); and that comparison, or *That...*$\times$*This...*, or standard One or *Energy*, *is a complete meaning*. So we begin to state the implications of our "scientific" equations, just as was done with *This*'s and *That*'s in §§33-7, as a means of finding out how to make any valid scientific equation or statement. It is a repetition, in "scientific" terms—and so I shall condense considerably. The reader already knows the principles—he will see merely the rigorous, definite application of them, which of course serves as final proof of those principles of language.

d. The orthodox expression $F\times L$ (which equals *Energy* or ML^2T^{-2} [§70a], F_e being equal to M_eLT^{-2}) is obviously an *implication* that a standard M_e *might* move over a space L_e relative to the implied M_e *at that location*—i. e., the L_e is the implied space *between* the two implied M's, and hence is the "*potential*" (i. e., 'implied' or "possible" motion) of the two. Consequently, the conventional $F\times L$ is actually $F_e\times L_e$ when it is *explicitly* written and is a pure mysticism equivalent to the similarly pure mysticism ML^2T^{-2} or its *explicit* equivalent $M_eL^2T^{-2}$—i. e., it does not *assert*, but only *implies* motion. But clearly, those *implications* of naming or "measuring," just as we saw in the discussion of *That...*$\times$*This...* (§36), *explicitly imply* the form $(M...\times M...)L^\infty T^{-\infty}$. That form, depending on how we modify its symbolic expression, clearly is identical with either the first or the second member of our general equation—to either *That...*$\times$*This...* or to M(*varying with*)L^2T^{-2}. As we wish to retain conventional symbols (I am *forced* to, *if* I *translate* them), we may therefore write that form as $F...\times L...$ (and further as $(M...)L^2T^{-2}$ or $(MC)L^2T^{-2}$; see §72d). $F...$ and $L...$ are *actual* Many words—not the standard units or M's taken as the One that are used in the orthodox absolutely mystic formula $F_e\times L_e$ or $F\times L$.

e. As we shall see in more and more detail, any scientific equation may have a member of that *That...*$\times$*This...* form. In that $F...\times L...$ form the $F...$ (or the orthodox F or F_e) or analogous term, is conventionally named the *extensive factor*; and $L...$ (or L or L_e) or any analogous term is the *intensive factor*. Obviously, "extensive factor" agrees with the usual meaning of *That*:- something away from this; a completing part or factor, *extending* the *This* out. And "intensive" is *This*—something *intensely* right here.

f. In this book I always print as the *first* in the pair *That...*$\times$*This...*, the factor which seems to be usually regarded as the *extensive* one. '*That*' obviously by usual convention has a meaning more "extensive" than '*This*'—*but not necessarily so*; it depends solely upon the point of view.

g. Also, those two factors, $F...$ and $L...$ and all analogous ones, are both *irrational* factors. I. e., *each* is utterly meaningless when used alone: *factor* itself means a *part*, and clearly a part truistically is not a whole or meaning, but explicitly implies incompleteness, and lack of positiveness. That simply means that *any* Many word *implies* all the other parts of the Many—that it is sheer, irrational nonsense to say that a Many word, which formally names a part, simultaneously is not formally a part, but is formally an absolute Whole. —— Also, the expression $F_e\times L_e$ (or its more conventional form $F\times L$) from the point of view of *positiveness* is obviously utterly irrational—as F_e and L_e are by verbal agreement fixed or formal standard units or Ones that *as such* logically or truistically contradict being related with the resulting *variableness*. *Only* as we let $F\times L$ *imply* other expression which *is* variable and actual and hence positive can it have any actual meaning; *otherwise* it is really (as well as *formally*—and in order to handle the One and Many with valid logic it must be formally or verbally) dualism or the old classic logic, and fundamentally also really nonsensical. E. g., some militaristic Germans tried to consider the *This* which was their *State* as being *alone* worth considering, and a being a real One—and many of the historical results clearly showed the stupidity and ridiculousness of their view.

h. So it is already generally evident that the difficulty with orthodox physics is that it is not sufficiently explicit. It unwittingly tried to "simplify" too much and fell into religious or mystic expression. "Simplification" actually consists of translation into familiar ("common") terms; it does not mean the ignoring of many things that actually exist, in order to get mere superficial verbal brevity.

i. In using such pairs of factors physics obviously uses precisely the same sort of Many names, in precisely the the same sort of way, that ordinary language does. Hence, the factors may be called *naming* factors; the more explicit second member of the equation is the *measuring* member. E. g., in the orthodox physics of gases the names are *pressure* and *volume* ($p\times v$; and clearly p and v indicates names more definitely that they do measures, although both are the same in the end); in heat, they are *entropy* and *temperature* (*Ent*$\times$*Temp*); in electricity, quantity of electricity, and potential or intensity or pressure of electricity ($Q\times P$); etc. In Richards's explicitly complete extension of Van der Waals's gas equation or kinetic theory, orthodox physics definitely requires or uses the dots, or infinite regress, after those Many names or factors (§§82, 92-3). So I am agreeing with orthodox physics, and not really doing anything new.

j. That covers broadly the theory of the first member of

our general equation, as it is used by "science." We go on to the broad consideration of the second or measuring member, and then take up details.

§72. a. Explicitly speaking in "scientific" terms (and that explicitness makes this paragraph unfamiliar and queer in form), a specified amount of *energy* (i. e., a standard or whole universe or One, *Energy*) *is equal to* the *movement* of a *specified quantity of matter* (which quantity or Many part is hence truistically, or formally necessarily, named relatively to *at least one other specified quantity*); and that meaning of energy truistically implies that the movement must 'verbally *take place*' or *be expressed*. I. e., *Energy* is motion (*expressed* of course as the "measure" of it); but further, the *verbal assumption* of such motion (which is of course necessarily made when we try to *express* energy) requires a *verbal assertion* of motion—a formal truism which orthodox science overlooks, so that its *Energy* or $M_eL^2T^{-2}$ is not positive language: it should be $M_eL^3T^{-3}$, as we shall see. —— I have not there *assumed* "motion." Just as in §22, it was verbally taken that there *existed* something which we talk about; *if* so, *then* the *talk* of *relative* parts *is* "motion." Clearly, if a person does not care to say, with everyday people, that there is "motion," then he can take an absolutely static reality or Nirvana, in which nothing changes or varies, but which he *describes* by *arbitrary* variation in mere form or relationship of words—a "really" non-existent change, and hence a *verbal* proof *or truism*, of *absolutely no motion*.

b. I shall now express in symbols that explicit *Energy*. The '*specified quantity of matter*' is expressed in standard units by M (or M_e). The '*movement*' is, in verbally the most parsimonious way, expressed by LT^{-1} (i. e., not with ultimate accuracy as a One by $L^{\infty}T^{-\infty}$). Then, still quoting from the last paragraph, the '*truistic naming of M relative to at least one other M*' requires at least one more verbal relationship form LT^{-1}. Next, in order to get the movement verbally to '*take place*,' and complete the most parsimonious set of truisms, we must have at least one more relationship form LT^{-1} (all that being the "scientific" point of view of §59). And letting the at least one more M (an M') be implied (or letting it be considered to have really joined with the standard M or M_e), and collecting together the three LT^{-1}'s that were used, we have:- $Energy=ML^3T^{-3}$, as a preliminary most frugal sort of expression of energy;—the expression is really mystic *unless* we include as being a part of it, its context that the M implies at least one more M; but our chief present interest is the L^3T^{-3}, instead of the L^2T^{-2} in the conventional ML^2T^{-2}. We can see at once that instead of L^3T^{-3}, complete expression would have been $L^{\infty}T^{-\infty}$—but we need not go again into the fact that L^3T^{-3} is a *practical* replacement of that infinite regress and makes the equation inaccurate (§38). Further, orthodox equations omit and thus imply one LT^{-1} both in defining *Energy* and in making the actual measurements. I. e., in making the measurements those orthodox equations tacitly assume that the *observer* moves at zero velocity in order to measure (i. e., that he sees both M's simultaneously), or at an infinite velocity (i. e., asserts a space between the M's, but ignores its existence or passes over it in zero time)—all of which amounts to asserting $Energy=ML^2T^{-2}$, which expression hence actually asserts that there is absolutely zero potential (or zero L) between the two M's, so that they really could not exhibit any energy. It therefore results that ML^2T^{-2} is absolutely *not, of itself*, the positive expression of anything, even if the M is considered as expressing at least two M's: it is absolutely ineffable. *But*, it furnishes a standard One, and it *together with the context we are to supply* is to be used as a scientific expression for *Energy* just as it is now used.

c. We noted in the last paragraph that in measuring the unified bodies M_e in $M_eL^2T^{-2}$, we tacitly assumed that the observer (in going from 'egg' to 'pencil' as in §36) took his speed of measuring or observing to be either zero or infinity —i. e., to be *absolutely constant*, and *hence as not needing to be expressed*. If the speed is not such, then (as a verbal truism shown in §36l—or as a truism of the fact in par. a that the M's are "moving") every M, for each person at each instant, is necessarily designated by a different name, or else there is a quantitative inaccuracy (as a matter of fact, our speed in that measuring or observing is, to use ordinary language, the velocity of light; so the inaccuracy is slight with respect to things in our everyday practical environment; but it is indispensable that we notice the logic definitely *if* we are to claim to talk consistently and carefully, and are to have a valid or even a really intelligible physics). Orthodox science takes cognizance of those facts in relativity (§66); we are now going to do so without having to abandon our mutual language and then have a formally private language for each person. Obviously, the only *possible* way to make our equation for *Energy formally* correct is to put in, or express explicitly, that it is quantitatively inaccurate (which inaccuracy of course resulted when we dropped the explicit $L^{\infty}T^{-\infty}$), *and* also *of itself* has a *logical omission*.

d. Now, the ordinary standard unit M_e which we use is a gram-mass, which is the "matter" or substance or part of the universe that is the 1/1000 part of a lump of platinum kept in Paris (Daniell's "Physics," 13). We distinguish it —*only* can observe or measure it—because its outer atoms or molecules have zones of ether that move at about the velocity of light in our neighborhood (XIII)—actually a varying velocity itself (§127). We ourselves as a *molar M* are more or less at rest (static) compared with that high velocity—not absolutely so, however. Therefore, we assume that we take an *average M*, and that we may formally for verbal purposes take it to be absolutely fixed and constant always and everywhere—i. e., is explicitly an M_e. Then, because we observe that any actual body or M... varies, we must add to that formal M or M_e the dots ..., *or* a *numerical coefficient* (a "number," such as 1 . 0002...: it can *never* be accurately a commensurate or "rational" or exact number), which we shall call C (that C indicating that we are referring to "ordinary" or *molar* bodies, as arbitrarily distinguished from electricity, atoms, light, etc.). Or, MC is merely another way of writing M... or M(*varying with*) (§71b); we use that way because conventional science in a number of cases *in effect* has such letter symbols in its equations. In writing its equation $Energy=ML^2T^{-2}$ orthodox science omits explicitly including any equivalent of C—thus (1) taking it quantitatively for granted that C is equal to 1; and (2) taking it logically or *qualitatively* for granted that C is always steady or a constant, which is absolutely wrong. As a matter of fact, in most practical affairs with *molar* bodies, C substantially is equal to 1, and is *approximately*, but never qualitatively, a constant. But in heat, electricity, light, chemistry, all molecular physics, most gas phenomena, gravity, biology, psychology, etc., C is so far from being a constant, and has changed so much from its quantitative value in *molar* physics, that in most of those cases orthodox science explicitly gives 'C' a name, experimentally finds it to have that *changed* value (sometimes an enormous change), and hence usually gives the 'C' *different* names, and also names those 'cases' or "phenomena" or "branches" of science differently, taking the 'C' of each to be unity *for that branch*—thus splitting "science" into "parts" or *formally* disconnected branches, whereas nothing changes between any two branches but velocities, or the measures of velocities—both being arbitrary

anyway. The real confusion in science is caused by the fact that in effect in each branch the original formal or qualitative error is repeated:- that of asserting that the new 'C,' with its different value, is a *constant*—thus in effect asserting flatly, with no experimental proof of it, that a unification of science is impossible, and making a verbal impass that has produced the queer relativity theory as an exaggerated reaction. —— Therefore, from the point of view of the measuring member $M(varying\ with)L^2T^{-2}$, our unification of science will consist of replacing the '*(varying with)*' with the symbols already mostly found by science, and showing that not only by our already observed verbal truisms, but also by "scientific experiments" those symbols are all identical in character and in measured quantity vary continuously so that there can be nothing but an arbitrary quantitative line between "different" phenomena. That is obviously identically the same in principle as unifying science with respect to the first member by always *explicitly* adding the dots as in $F...\times L...$ (§71e-i); here, $M(varying\ with)L^2T^{-2}$ is equivalent to $(M...)L^2T^{-2}$, and we are to be explicit about the dots.

e. We may now see very briefly some general direct experimental proof that every actual body varies:- (1) The quickest statement of that proof is:- observe that every actual body changes—very perceptibly so if we watch it for a long enough time. (2) The general technical experimental proof is that it is observed that mass varies with velocity. (3) Particular proof is, that it can be noted that *every* so-called physical constant unit has to be described carefully as to date and place—numerous conditions given—before it is considered to be even approximate; and then it is agreed that no two observers of it are likely to coincide exactly in their measures. The variation is orthodoxly called "personal error," etc., but no proof exists that man is subject to variation or "errors" while other bodies are miraculously immune. That is a direct implication of the infinite regress—of the symbolic need of dots in $M...$, or of the C in MC. (4) Further, modern physics, in mechanical theories (in the naming member $That...\times This...$), substantially reduces all phenomena to a passage or flow of electrons (which have mass and weight) between the various bodies involved in the phenomena; so truistically, the bodies or M's vary. (E. g., if we were merely to *look* at the standard 1000-gram body in Paris, it actually changes as a result, due to the passage of electrons in the light phenomena that are involved [XIV]. It is quite true that the change is of practically no quantitative importance—it would probably be too small to measure by any direct means now available. But it is equally true that it is absolutely wrong to *assert*, by conventionally using ML^2T^{-2}, that there is *no* change.) —— We see other experimental proofs throughout the rest of the book.

f. Consequently, we have in physics, for the fundamental positive equation for molar bodies (subject to an additional implied LT^{-1}):-

$$F...\times L...=MCL^2T^{-2}=Energy(molar).$$

§73. a. We shall at once plunge into the meaning, implications, and expansion of that somewhat odd looking equation. What we are going to see now is shown in §§75-81 to be nearly explicitly what conventional science asserts in electricity and substantially in heat. So there is essentially nothing novel about our equation.

b. We have seen that each of the first two members implies at least two M's. The $L...$ in $F...\times L...$ is implicitly an assertion of a *molar* body, which we can consider to be M'. Now, we wish to assert the relationship of $F...$ and $L...$ more explicitly than that abbreviated $F...\times L...$ does it. I shall condense the statement of that relationship in this paragraph; but not until all the meaning of the equation, including the explicit mathematical values of $F...$ and $L...$ (par. g), is seen, can this paragraph seem very intelligible. —— We take it that a relationship (the $\times$) exists across a space between two molar bodies M and M', and we wish to express that relationship with formal completeness (when we do that I usually name the $\times$ more explicitly:- F_r). The surfaces of the bodies are their sole *property*, as *molar bodies*—a truism, as *property* simply ultimately means '*an expression of, or a concrete, separation into parts,*' as we shall see more and more clearly in this chapter. I. e., a body is a *molar* body when we consider that it has a *surface* zone of motion—the *insides* of the body being static or motionless so far as formal expression explicitly goes (of course, such a condition is *never* true of any actual body, and hence such *formal* molar equations are *never* accurate—and unless understood to imply the present context, by the agreement that C is variable infinitely, conventional *molar* or static equations are illogical). Furthermore, because of the formally omitted LT^{-1}, the space between M and M' is also considered to be logically negligible, or constant, or static, or traveled over in the process of naming in absolutely zero time (§72b), so that that space is simply and solely the *division* (a relationship) of the One into at least two parts. (I. e., the $L...$ tends to take on the form L_r, and finally changes in the L_e which is the "L" in the orthodox $F\times L$; —the three forms of the Trinity are so intimately mixed in that "L" that to reform the confusion science humanly used the unnecessarily violent method of revolting to relativity, in which the L_e, or the L in MCL^2T^{-2}, is entirely thrown away or repudiated verbally—although still tacitly used.) Hence, that space L_r (actually the $\times$ in $F...\times L...$) is formally or logically a symbol or a 'surface'—what I shall call a *difference surface*, meaning not a geometrical surface, but a bounding *zone*. —— Incidentally, the "F" in the orthodox $F\times L$, when that $F\times L$ is implicitly taken to have a meaning, like our $L...$ implies other forms of the Trinity; but technically the orthodox $F\times L$ is a rigid and hence mystic $F_e\times L_e$, as we shall see further.

c. We have then a formal relationship F_r from M' extending across a logically or formally dead or static space which we may call d (distance: it is a conventional symbol, equivalent to L), to another body M. I. e., the two bodies are *actually* united, but we *verbally* take them to be separated by the formal relationship space d, and then assert the relationship force F_r as uniting them—that being the usual formal cancellation of the verbal contradiction in the One and Many. I shall call that F_r across an absolutely formal relationship space:- '$F_r(molar)$'—in agreement with the conventions stated in the last paragraph. —— As we are speaking ordinary 3-dimension language, therefore, as a truism (cf. §§36de, 59), as we move formally (as a relationship LT^{-1}) from M' to M, the cancelling relationship or force F_r (which here takes the place of the usual "time"—or is an "objective" synonym of the "subjective" T; cf. §§150-1) must also spread out into the other two dimensions; for, the relationship is inclusive of all M's, as a truism of its original introduction into the discussion; or, M itself (by §59) has by our parsimonious explicit language, three dimensions. Putting that observation of verbal truisms into ordinary symbols, we have:- $F_r(molar)=M(LT^{-1})M'/d^2$. (That LT^{-1} indicates that those M's are actual $M...$'s and not M_e's.)

d. That equation resembles Newton's law of gravity—would be it explicitly if we hadn't taken the trouble to be explicit about the LT^{-1}. But it is not any law of gravity. It is, so far, simply an explicit statement of a relationship named F_r which is true anywhere in the universe across any portion of formal relating space between molar bodies—and

as such is a symbolic, brief expression of simple truisms of the naming or *arbitrary* recognition of such bodies as formal parts of the One which they constitute. It is nothing more; it is a verbal *preparation* or agreement or *form* for measuring, or for *expressing* observations, and is *not* the actual measuring or expression of actual measuring or experiments. Or, it is what is conventionally called the mathematical *limit*; it is the ultimate abstraction and applies to no actual phenomenon (§83f, etc.). And it is important to observe that that so-called inverse square law which appears in that equation (the $/d^2$ or $\div d^2$ or d^{-2}), and which appears so often in science, is nothing more than a verbal truism based on the agreement to use 3-dimension space. The inverse square law is purely logical—an *agreement* of speech. That law *explicitly* is:- $(M...)(M'...)/d^2$. As we shall see, the *measured* or observed so-called force between any two distinguished-apart *actual* bodies is *never accurately* stated by the form M_eM_e'/d^2; that form (more conventionally written MM'/d^2 or M^2L^{-2}) *assumes* the existence of a *constant* relationship F_r which is never *actually*, or in a Many sense, the case, as M's always change (§72). —— A good physicist could readily finish writing the valid physical equations from just that crucial logical point. But to save him work I shall develop some of them; and we shall see more intelligible details of those very broad conclusions as we proceed (§§77, 83, 98, Index, "Static and dynamic").

e. We may write that equation:- $F_r=(M...)(M'...)d^{-2}$ or $F_r=(MC)(MC)/d^2$ or $F_r=M^2C^2L^{-2}$. That simply puts it in conventional form—one which is analogous to electrical equations, and is *in superficial form* like Newton's law. We could have used any other symbol beside C, and given that symbol any numerical exponent besides that 2. As a *standard* of measuring, the inverse square law or formula of course becomes $M_e^2L^{-2}$, where the C is the average 1.

f. As we saw, $F...$ in $F...\times L...$ *explicitly implies* an $M...$. We may *arbitrarily* take it that $F...$ is one of those $M...$'s in $M^2C^2L^{-2}$: or, $F...=M...=MC$. (That does *not* mean that $F...=$*the* MC *in* MCL^2T^{-2} of §72f, any more than that one of the six dots here printed in $F..:\times L...$ is equal to one of the three dots in $M...L^2T^{-2}$. *If we wished*, we *could* interpret $F...$ as the MC in MCL^2T^{-2}; it would merely result in making a different *distribution of names*, and would make MC in $M^2C^2L^{-2}$ have some other name. Also, see next paragraph.) When we thus talk of $F...$ as being an actual body $M...$, we are doing precisely what conventional science does in talking of $F\times L$—except for the secondary fact that science means by "F":- F_e, or an ultimately average or standard or abstract "M." Orthodox science says that that F_e is a force that "resides" on or in the body, which by moving through L displays the $M_eL^2T^{-2}$ or *Energy*. Now, if one entity "F" "resides" on another named "M," then that 'residence' is simply an implication of a relationship not explicitly expressed. Hence, without repeating all the truisms as to the identity of relationships (§28h), it is a truism that the $F...$ (or the orthodox "F") is identical with the $M...$ (or with the orthodox "M" in which it "resides"): a sufficient practical explicitly expressed proof of that for this place is that "M" is tacitly taken to occupy all the space it occupies, and as the "F" is held to be in the same space, then by science's "axiom" ($A=A$ agreement) that two things can not occupy the same space simultaneously, the "F" must be the "M." So we are quite in agreement with conventions in taking $F...$ to be an $M...$— although verbally we are more explicit. —— That truism that a "force residing" *is* the body itself in which it resides is an important one, although here condensed into a few lines, as an incident to another subject. There are numerous attempted absolute dualisms in conventional science between "F" and "M" because the "F" "resides": that truism eliminates them all.

g. Therefore, *inside the narrow special limits* in which we take our average or standard units M_e, L, T, we have F_r(*molar*) on an average (i. e., in *mutual* language or names) giving a unit acceleration to a unit mass; or, as a *mutual*, standard statement of unit *quantities*, $F_r(molar)=M_eLT^{-2}$. Therefore, we have the explicit, definite, actual translation of actual $M...$'s into *mutual*, average, standard language:- $M_eLT^{-2}=(M^2C^2)L^{-2}$. (Incidentally, that equation shows explicitly why $F...$ is *not* the MC in MCL^2T^{-2}; cf. §70b.) Then, for the $F...$ in $F...\times L...$ we obviously have:- $F...$ *or* $F...$(*matter*) *or* $F...$(*molar matter*) *or* $F...(static)=MC=\sqrt{(M^2C^2)}=\sqrt{[(M_eLT^{-2})L^2]}=M_e{}^{1/2}L^{1\frac{1}{2}}T^{-1}$. That is *explicitly* $F...$ (which we were after), *when* or *if* we are making molar measurements or experiments under *standard conditions*. —— Hence, $L...(static)=MCL^2T^{-2}/M_e{}^{1/2}L^{1\frac{1}{2}}T^{-1}=M^{1/2}CL^{1/2}T^{-1}$. And $F_e(static)=F.../C=M^{1/2}C^{-1}L^{1\frac{1}{2}}T^{-1}$. And $L_e(static)=M_eL^2T^{-2}/M^{1/2}C^{-1}L^{1\frac{1}{2}}T^{-1}=M^{1/2}CL^{1/2}T^{-1}$. Therefore, as a truism of course, $F_e\times L_e=M_eL^2T^{-2}$, which is the same as the orthodox equation $F\times L=ML^2T^{-2}=$*Energy*. So it is obvious that we have not at all found any real error in orthodox physics—we have merely been explicit as as to what the conventional equations mean.

h. We may get a preliminary general understanding of those equations by considering that orthodox science, in those it asserts, is absolutely anthropocentric—takes the observer, or the asserter of the equations, as being a standard One, who then talks absolute mysticism. For the conventional F_r (in "$F=MLT^{-2}$") obviously consistently refers *only* to what the observer considers actually *coincident* with himself at a 0 (or ∞) point in space and time, which conditions are taken arbitrarily as a unit or standard, or as an absolute point of reference for subsequent comparison. Then, he asserts, in calm and complete disregard of all the actual facts and of all verbal consistency, that that absolute One moves a distance L (in $F\times L$) and gives $Energy=ML^2T^{-2}$. Clearly, (1) *motion* is then an absolute assumption of something which truistically is then unexplainable and indefinable (the observer as that anthropocentric One is an *immovable* body, and it can't move, according to our usual verbal agreements); (2) that distance L also becomes some change referring to the same absolute One, and is precisely analogous to the *motion*; and finally (3) there is absolutely nothing whatever stated as to *why* that absolute One *should* move or exhibit energy;—there is expressed or given *no* potential—no 'possibility' of travel through L, whatever that "travel" or "motion" might be—nothing to make that One move. —— Those difficulties have now been shown to be purely verbal, and we have obviated all of them but one, by being verbally explicit and showing the logical truisms, thus:- We do begin by anthropocentrically adopting a One standard, $F_r=MLT^{-2}$; and we end by translating back into an anthropocentric One, $F_e\times L_e=M_eL^2T^{-2}$. But in doing all that we have included expression of all changes and have thus succeeded in making our One standard *average* (instead of uniquely and rigidly individual or anthropocentric), and hence mutually intelligible, and universally applicable. The *defect* in the explicitness (the lack of completeness in logical truisms) in the equations in the last paragraph is that no potential is expressed in them or by them. I. e., I omitted explicit assertion that in order to make F_e become $F...$ the space between M and M' (par. b, and §72b) can not be static or dead or *verbally negligible*. I. e., an LT^{-1} was omitted—the inclusion of which would have given us the explicit expression for energy. *As a truistic consequence of that*,

as we saw in the last paragraph $L...$ and L_e have identically the same value, $M^{½}CL^{½}T^{-1}$. L_e is the formal verbal *agreement* that there *may be* a potential, which our $L...$ then (as a consequence of omitting that LT^{-1}) merely names without asserting (just as the anthropocentric $F \times L = ML^2T^{-2}$ fails to state what it is that is going to cause—to 'assert'—motion). Therefore, our equations in the last paragraph merely *name Energy*, and do not state that it *is in existence*—i. e., do not *finish* stating that we did divide the One as per agreement and then put it together again. That is quite in harmony with the commonsense, valid conclusion of orthodox science about its *Energy*:- that energy which *is* actual energy —which *does* move— is "*power*," or ML^3T^{-3}. Therefore it is obvious that we may use a form of ML^2T^{-2} for *Energy*, instead of ML^3T^{-3}; but we always have to remember that it *names* energy only, omitting an LT^{-1}. Perhaps it may be preferable in the future to be quite explicit about *Energy* and put in that LT^{-1}—it is a matter of expediency; of what is verbally convenient. But in this book I am forced to use both the old verbalisms and their new and more explicit forms, and neither my own brain nor the usual reader's can support the strain of completely changing here.

§74. a. We can now see just what Newton's law is, and how he got the logic wrong. Numerically, Newton's law is written $F(of\ gravity) = MM'G/d^2$, in which G is orthodoxly taken to be a real constant number, determined by measuring. Newton and those who believe Newton's law to be logical (Newton himself seemed to be doubtful as to whether his "law" was self-consistent) assert that G is constant—is everywhere and at every-time the same, regardless of the relative circumstances of M and M'. As an actual fact, Newton *guessed* that G was a constant, and found that his guess was *fairly* accurate with respect to the large bodies, considerably separated, *inside* the solar system. Newton didn't know much about the *principles* of gravity, and he knew that he didn't, as I implied in the last sentence (see Brewster's life of Newton). However, it is now known that G is not accurately constant even for such measures inside the solar system (Eddington, lecture Royal Inst., reprinted from "Nature" in "Sc. Am. Supp.," July 6, 13, 1918; Tunzelmann, "A Treatise on Electrical Theory and the Problem of the Universe," 418). Also, two more or less adjacent molecules of a body obviously may be considered two M's, and it is glaringly evident to physicists that Newton's law fails to apply accurately between them—that there G is not a constant, and not even near the value of the orthodox G. Hence, quantitatively, Newton's law is experimentally known to be inaccurate. Logically, it is wholly wrong, if it is supposed to apply to any *actual* bodies, as we see in the next paragraph.

b. In speaking of gravity it is taken for granted that it is some sort of "force" W (explicitly it is $W...$ in actuality, or W_e as an average unit) "residing" on or in *all the parts* of a body—including the *insides* of the body. That is shown to be the case by the fact that we speak of the pull of gravity traveling, apparently unchanged (cf. §83f), *through* bodies and into all their parts. It therefore follows that in naming the force of gravity [$F(gravity)$—which of course at once *implies* $F...(gravity)$] we consider the whole insides of the two M's in the orthodox expression $MM'G/d^2$ as being split up in parts—i. e., M and M' are *structural*, or internally *moving relatively*, [74b] or *dynamic*. Hence, as the M and M' are moving inside, Newton's law ought to be simply a dynamic statement of moving bodies, of which $F...(static)$ in the last section is the *static* form. Therefore, as the bodies which explicitly assert gravity [the bodies which have a 'resident' $F_r(gravity)$], or have $W...$, are dynamic (are really, *ultimately*, divided into relatively moving parts in infinite regress), we simply explicitly and consistently say so, as a verbal agreement of *naming*—i. e., we state an *if*,—thus:- $F_r(gravity\ or\ dynamic\ matter,\ or\ dynamic\ "molar"\ matter) = (M...)(LT^{-1})(moving\ M...)/L^2$. I. e., as in the last section, we have to *name* M and M' *relatively* to each other, with F_r spreading out in the other two dimensions, and we hence *first* have $M(LT^{-1})M/L^2$; but then, we said that each M was itself internally split, so we have to make those M's into $M...$'s; and then as there *was to be* relative motion (not *is*, but merely potentially, or *if*: an *if* of mere 'existence' or preliminary verbal form), one of those $M...$'s is a '*moving M.*' Now, as in the *special* circumstances in which Newton's law $MM'G/d^2$ is true the M's would have to be absolutely static, it follows that if we have dynamic $M...$'s we would have to write for those M's or for $MG^{½}$ of Newton's law the expression $MG^{-½}$. And for the '*moving*' we write LT^{-1}. Hence, we have the equation:- $F_r(gravity) = (MG^{-½})(MG^{-½}LT^{-1})(LT^{-1})/L^2 = M^2G^{-1}T^{-2}$. Therefore, *if* as standard units $F_r(molar)$ *is* $= M_eLT^{-2}$, *then*, as a *universal* law true everywhere at every time, $F_r(gravity) = M^2G^{-1}T^{-2}$, in which G is a *variable* number with relationships to be indicated below. That is the actual quantitative law of gravity, consistently expressed in everyday Trinity language: it is identical with Ampere's law in electricity, and can be understood better by comparing it with that law (§§76-7). Newton's law is a static statement of a special case, and is not logical even for that. For the mechanics of gravity, which are very simple, see §§103, 134. The valid 'law of gravity' is, of course, not intelligible at all, *as such* or *of itself*, for the most excellent reason that it is merely a statement of an *if*:- *if* so and so is *verbally agreed-upon* as a manner of speech, *then* we *may* measure or speak in a certain way, and *will later on* use such preliminary measures (or 'irrational' or of-itself-unintelligible factor; §71g) in the expression of such and such a One or standard One;—but the law does not in the least make that *intelligible statement of energy*, or pretend to. And that *if* is easy to understand *as* a partial statement, and is completely "explained," it amounting to this:- *if* we agree to name a boy *John*, *then* we are prepared to say that *John* did so and so.

c. We hence have, precisely as in §73g (and as we see again in electricity, §76d):- $F_r(dynamic) = M_eLT^{-2}$, as unit, average naming agreements. And, as a translation of actual $M...(dynamic\ or\ gravitational)$:- $M_eLT^{-2} = M^2G^{-1}T^{-2}$. Hence, $F...(dynamic\ or\ gravitational) = W... = MG^{-½} = \sqrt{[(M_eLT^{-2})T^2]} = M_e^{½}L^{½}$. We shall use $A...$ (*chemical Affinity*; see par. e for description of it) as the intensive factor corresponding to the extensive factor $W...$, so that $W... \times A... = Energy$. Then, $A... = MG^{½}L^2T^{-2}/M_e^{½}L^{½} = M^{½}G^{½}L^{1½}T^{-2}$. And $W_e = W.../G^{-½} = M^{½}G^{½}L^{½}$. And $A_e = M_eL^2T^{-2}/M^{½}G^{½}L^{½} = M^{½}G^{-½}L^{1½}T^{-2}$. And as a truism, $W_e \times A_e = M_eL^2T^{-2}$, which is an equation missing in orthodox science, that in strictly conventional terms would be $W \times A = ML^2T^{-2} = Energy$. Because Newton's law formally is erroneously stated (as was shown in the last paragraph) that equation in orthodox science uses instead of A the

[74b] Hence, it is at once a glaring truism that Newton's law, by making G constant, in effect asserts that the M's are fixed, constant, and unchangeable, and hence *not* structural. Therefore, the very *form* of Newton's law asserts that the mechanics or the description of gravity is *non-existent*—is qualitatively or absolutely impossible. The orthodox law of gravity is static, and gravity itself is dynamic. An eternally dead or absolutely static One has no "mechanics," as a mere truism—unless we shift to a different language from the one Newton was talking, which is our ordinary one. Thus it is seen that a "mechanics" of *Newton's* gravity *is impossible.*

orthodox *static* potential symbol L, and writes the equation $W\times L=ML^2T^{-2}=Energy$—which is obviously a very confused, and except in narrow conditions, wrong expression.

d. It therefore follows at once that the comparison of $F\ldots$(*ordinary molar bodies, or static*), and $F\ldots$(*dynamic bodies*) or $W\ldots$, instead of being the nonsense orthodoxly derived in §70b, is:- $F\ldots/W\ldots=M_e^{\frac{1}{2}}L^{1\frac{1}{2}}T^{-1}/M_e^{\frac{1}{2}}L^{\frac{1}{2}}=LT^{-1}$,—or, is a velocity. Obviously, in order to get the *expression* of dynamic matter from the expression of static matter we truistically deliberately inserted a velocity, LT^{-1}, in par. b. So as a cancelling truism, it comes out again when we compare static matter ($F\ldots$) with dynamic matter ($W\ldots$). The explicit velocity which we put in is the velocity of light—which we use as a distinguishing criterion in naming. Explicitly, $F\ldots/W\ldots=MC/MG^{-\frac{1}{2}}=CG^{\frac{1}{2}}=LT^{-1}=$*average velocity of light here and now* (see par. f). Hence, purely by verbal agreements, LT^{-1} is the velocity of light, just as we see it is in electricity (§77), and in all the other "branches" of physics or knowledge (§§83, 100, 136, etc.). The fact that in electricity, etc., the same verbal LT^{-1} is also experimentally observed to be the velocity of light is nothing more than the observational verification that in that branch the same criterion was put in as a verbal form and then orthodoxly kept unconfused. —— The reader is not likely to grasp that general unifying point in its entirety until he has finished the book. It is merely a rigorous expression in terms of physical measurement of the fact that the total universe is inseparably related. If you do not happen to be interested in remembering or seeing how the technical language or slang of physics expresses it, you lose nothing essential in passing over this casually; for the same facts are later on expressed in familiar terms of everyday life.

e. We noted in par. c that orthodoxly $W\times L$ and $F\times L$ are considered logically identical; but we saw (§73g, and in par. c) that they were not so: in a rough quantitative way in fairly steady *molar* circumstances here and now they may of course be used alike. We need the special symbol A for the "L" in "$W\times L$." —— We saw in §71e-g that $F\ldots$ (and implicitly $W\ldots$) is an incomplete expression—a factor, irrational when used alone. $W\ldots$ itself (par. b) simply names matter considered divided internally in parts. Suppose we name those parts *atoms* (we could give them *any* "structural" name: *atoms* happens to be a familiar one, and later we see that atoms are the conventional small parts which have an outlining zone of motion at about the velocity of light). Then it is obvious that $W\ldots$ simply implies a verbal agreement to speak of atoms—implies that there are *This*'s, compared with which $W\ldots$ is *That*'s. A W (without dots)—a "weight" just in itself, asserting or implying *un*related *That*'s—really asserts chaos: has absolutely no meaning. Clearly that is true; for *weight* means something *only* when we consider whatever it is that has weight as being (so to speak) stuck to the earth, or combined with or compared with the earth (or sun, etc.). And obviously, in our explicit scientific language, we want a *word to go with* W which will be an *any*thing to which the M implied by the W is stuck: we do not, in describing the universe, wish to express everything *directly* and *immediately* in terms of our little earth—it would be provincial, to say the kindest thing about it; sometimes the earth is too small, and other times it is too large, to be a useful comparison. The usual name for whatever it is that makes things thus stick together—especially atoms—is *chemical affinity*. We may give it the abbreviated name A. Incidentally, that A is not the A (which represents *any* symbol, word, thing) in our formal truism $A=A$; but the two are always readily distinguishable by the context. So we have (as already seen in par. c) the dynamic or gravitational equation for matter in general (as distinguished from the matter that is electricity, light, etc.):- $W\ldots\times A\ldots=MG^{\frac{1}{2}}L^2T^{-2}=Energy$(*dynamic or gravitational*).

f. I shall be more explicit as to the comparison of static matter and dynamic matter—which comparison gave (par. d) the average velocity of light in our neighborhood (which velocity I shall abbreviate to V_1). We had $F\ldots/W\ldots=MC/MG^{-\frac{1}{2}}=CG^{\frac{1}{2}}=LT^{-1}=V_1$. That equation assumes that we talk of the same actual M from two points of view:- the static and the dynamic. So the $CG^{\frac{1}{2}}$ obviously merely states that one point of view is in or from a static velocity, and the other point of view is to consider ourselves as observers in a dynamic body with a velocity of $CG^{\frac{1}{2}}$ units (which is V_1), looking at a static body. We may get that numerical ratio more explicitly:- $F_e/W_e=M^{\frac{1}{2}}C^{-1}L^{1\frac{1}{2}}T^{-1}/M^{\frac{1}{2}}G^{\frac{1}{2}}L^{\frac{1}{2}}=LT^{-1}/CG^{\frac{1}{2}}$; hence, if the bodies on which the standard units F_e and W_e reside are the same, then $F_e/W_e=1$, and $LT^{-1}=CG^{\frac{1}{2}}$. Consequently, as our equations for matter are constructed with *perfect* generality, they may be transformed as desired, and converted into any other physical equations, especially the orthodox ones of modern electrical theory (see §§77, 83, 100, 136, etc.). Also, as we are taking C and G as being numerical factors of an explicitly variable V_1 (*which however is approximately the same for all of us on earth at any given time*), with the unit or standard M, L, and T formally fixed, it is obvious that those fundamental equations at once furnish a *mutually intelligible* base upon which to establish with rigorous identity all physical naming (although no quantitative *accuracy* is possible, for the simple reason that V_1 is never exactly the same for two persons). —— We may also note a simple fact showing that we have rigorously unified all possible naming:- The "density" of a body obviously implies that it is considered as a molar or formally not-internally-moving body; its dimensional equation is evidence of that:- $Density=ML^{-3}$ (Daniell's "Physics," 224). The "elasticity" of a body, as given by its resistance to direct compression, stretching, or shear, obviously refers to it as made up of mutually movable parts, which in general is the dynamic way in which gravity refers to a body. The dimensions of such direct elasticity are, $Elasticity=ML^{-1}T^{-2}$ (Daniell's "Physics," 263). Therefore, we have $Density/Elasticity=ML^{-3}/ML^{-1}T^{-2}=1/V^2$. Hence, if the same units are used, $Density/Elasticity=1/V^2=1/C^2G=1/K^{-1}U^{-1}$ (see §§80i, 95b; also, Tunzelmann, "Electrical Theory," 32). That again obviously unifies all of science, and directly connects this elementary theory to all valid physics, especially the usual Maxwell theory of electricity and its extensions. I. e., it is obvious if the reader is familiar with the physics I have cited: if he is not a physicist there is no special need that he verify the point, as the same thing is proved in familiar ways repeatedly below.

---

§75. a. We now take up fundamental electricity. We shall conclude that orthodox science handles it in rough generality quite consistently, and in precisely the way we have just found was necessary to express ordinary matter. We find that conventional science is, however, if we interpret it *explicitly*, wholly wrong logically about electricity, in that (precisely like Newton with his G) it considers K (which actually is analogous with our variable C) and U (which actually is analogous with our variable G) as *constant*. The experimental facts are, that those values *are* fairly steady in ordinary circumstances (i. e., vary almost "*constantly*" with the thickness r or L of the various "spaces"—actually the substances—through which the electrical "forces" act); nevertheless, measured values of them vary quite perceptibly from constancy (see "Ency. Brit.," ix, 245-6, and Art.

"Magnetism"). It could be claimed of course that those perceptible variations were variations in space itself; that gives the relativity theory (§66). But I am taking it for granted that we propose to talk our everyday Trinity language, and I am tinkering it into workable condition, after all the abuse it has received. —— Also, it will be shown that Ohm's law is empirical (§136); and that fact is shown to be directly equivalent to the principle that there is a variable K and U—that there is no exact science, or *no constant in the universe*; or mass varies with velocity.

b. Briefly, the "specific inductive capacity," or "dielectric constant," or "permittivity," or K of a substance is the numerical ratio of the electric force which it "permits" to pass, to the force which is passed by *air* taken as a unit standard (or its ratio to that passed by a "vacuum," according to some physicists: a vacuum acts practically as air does); i. e., K of air is 1. Thus, two bodies of static electricity exert mutual electric force on each other across a 'dead' or static 'difference surface' or space (specifically now in electricity, even orthodoxly, through an *actual* substance or "dielectric"), precisely as we saw molar force $F_r(molar)$ doing in §73cd. Hence, in precisely the same way, $F_r(static\ electricity)=(Q_sK^{-½})(Q_sK^{-½})/d^2$, in which $Q_sK^{-½}$ is a unit body of static electricity $(Q_s...)$, analogous in all respects to a molar body, with this explicit distinction (see XIV for details):- if an *actual* M and an *actual* M' be touched together and then separated, some of one of the bodies will *always* stick to the other; after the separation, if the amount of one which is stuck to the other is not '*molarly*' or grossly perceptible, we still call the bodies the *same* molar bodies M and M' (which obviously is *not* accurate or even rational, just of itself), and then proceed to correct that assertion by calling the amount stuck on one:- $Q_s...$, or *a quantity of (static) electricity*. Therefore, obviously, so long as that $Q_s...$ does not go moving around on the body *perceptibly* (it *always* does move some), and hence so long as we do not formally consider it split up internally, it is formally a lump or 'molar' body of an *attenuated* sort, definitely named *static electricity*. So we treat it as static. The orthodox equation is $F=Q_s^2/Kd^2$, in which K is supposed to be a constant of a nature otherwise unknown; I have merely changed that interpretation to agree with the *quantitative* experimental facts; and in order to make it logical, I am attaching the K (in place of the dots in $Q_s...$) to the "Q_s," thus:- $Q_sK^{-½}$. (It happens that K was orthodoxly put into the denominator of that fraction; hence, in accordance with that arbitrary and logically unessential agreement, the exponent $^{-½}$ of K is different in sign from that of our G.)

c. Briefly, the "permeability," or "magnetic permeability," or "coefficient of magnetic induction," etc., or U (which most texts symbolize by μ), is the ratio (a numerical coefficient again) of the electric force or relationship in any given case which is "induced," or *which "permeates" a body as gravity does*, with respect to the inducing magnetic force. I. e., two bodies of dynamic or magnetic electricity (which we shall see, especially in XIV, is static electricity "split up," or with insides relatively moving with V_1), are considered to exert electric force throughout (inside) themselves, precisely as we saw gravity doing (i. e., are considered to be completely related to each other, in all splittings, or in infinite regress—although *practically* we call the velocity of light average, tacitly using our eyes as a quantitative standard, and do not go to that infinity, but are content with the resulting inaccuracy). Therefore, following precisely the same truisms of expressions as were followed there (§74b), we may define a static magnet m as:- $F_r(magnetic)=(mU^{-½})(mU^{-½})/d^2$. Now, just as in §74b, if we take one magnet m as a unit, or 'static' beginning, or potential, and consider the other moving with reference to it and also internally, we at once, as our ordinary language agreement, have the *naming* equation (an *if* equation):- $F_r(dynamic\ or\ magnetic\ electricity)=(m...)(moving\ m...)(LT^{-1})/r^2$, in which r is an L (see next section for the mnemonic reason it is convenient to name it r). Substituting the coefficient U and the LT^{-1} for the dots, on precisely the same truisms or verbal agreements as before, we have $F_r(dynamic\ electricity)=(mU^{½})(mU^{½}LT^{-1})(LT^{-1})/r^2=m^2UT^{-2}$. In agreement with conventions (see next section), we may name a magnet that is actually taken to be dynamic or $m...$, and is not a static standard unit that is really a zero m_e:- $Q_m...$;—which stands for Quantity of magnetic or dynamic electricity; or, $Q_m...=mU^{-½}$. Hence, precisely analogous to the case of molar and gravitational matter (see next section for explicit details), we have $Q_{se}/Q_{me}=LT^{-1}/K^{-½}U^{-½}$; or, $LT^{-1}=V_1=K^{-½}U^{-½}$. We take K and U as being variable coefficients. Hence, that last equation, precisely analogous to ordinary matter in §74, unifies all of electricity. In the next section we see the logical details, which (§22) consist merely of universally applicable truisms—a rigorous explanation dry and hard to see just of itself. The "mechanics" of electricity —the easy description of *how* these rigorous explanations are true, and what they mean in everyday terms—is in XIV.

§76. a. The orthodox fundamental electrical equations which we shall need here are:- $F=Q_s^2K^{-1}L^{-2}$. $F=m^2U^{-1}L^{-2}$, where m is a unit magnet pole—really a static, or One, or zero m_e. $F=mcl/r^2=mcL/L^2$,—that being *Ampere's law*, which asserts that a unit current of electricity c flowing in a uniform conductor of length l (or L) that is arranged as a segment of the circumference of a circle of a radius r (or L), will exert unit force F on the unit magnet pole m at the center. [76a] $Q_m=cT$, where Q_m is a quantity of magnetic electricity; or truistically is the amount of electricity that is the sum of unit current c flowing for the unit time T. $Q_s\times P_s=Energy$, where P_s is electrostatic potential. And

[76a] In brief, *Ampere's law* is, as we shall see in more detail, the description of a method of using molar or static M's as a fixed zero point of reference or zero of potential or absolute "center," and *on* that formally, or agreed-upon, or *fixed* base dynamic "electrical" matter (which is precisely similar to gravitational matter) *moves*—actually does move (in everyday language). Obviously, we have, in Ampere's description, a *fixed base* on (or by or from) which to measure or observe the motion. (Clearly, identically the same thing happened in *static* electricity, as implied in §75b:- a very little of the *effective* surface of one molar body with *formally* dead insides stuck to another body, and then those molar bodies served as a fixed point of reference.) However, it is obvious that in considering dynamic gravitational matter it is not so simple to get that convenient zero point of reference or potential; actually in considering gravitational matter the *only* fixed point of reference is the *total universe* (hence, Newton's law is a *form* of *static* equation; he did not go on to the dynamic equation that was really needed, as apparently he was not able to logically get hold of a formal base on which to erect it—he needed to grasp the total universe as a base, and that seems to have been a bit too strenuous mentally for him and men of his time, although it is a commonplace performance of men nowadays). We are using the total universe here as a point of reference; *formally* it is nowadays still somewhat unfamiliar, and hence somewhat hard to follow here; but in human terms it is used in practice all the time, and the same thing will be quite easy to follow in Parts Two and Three. Hence, because electricity has an easily observed, and actually *quantitatively* rather stable zero reference, or arbitrary zero of potential (§80m), the orthodox theory of electricity is broadly valid, and quite simple (the orthodox error lies in assuming that the molar masses are *absolutely* static, although obviously they are not; *finally* we have to refer the electric point of reference to the whole universe as a standard). This general anticipation of the principles of this formal or logical unification of science is all that the general reader needs to comprehend; the physicist of course needs to wade ahead through the dry technical details of the explicit equations that follow in the text.

$Q_m \times P_m = Energy$, where P_m is magnetic electric potential—or more commonly is called electromotive force (E.M.F., or voltage). —— All those orthodox equations are supposed to be based directly upon measurements, experiments.

b. Those equations conventionally take it for granted that K and U are constant, or $_e$ dimensions, like M, L, and T. I shall show first that if that is so, then the equations will promptly give absurd, and flatly self-contradictory results. (I. e., the orthodox equations mix the three sorts of words: analogous nonsensical results were shown in §44.) Orthodoxly, $F = MLT^{-2} = (Q_s^2)K^{-1}L^{-2}$ . . (A) (I print Q_s in parentheses to indicate that orthodoxly it may be separated from the K.)

Then, by algebra, $(Q_s) = M^{\frac{1}{2}}L^{1\frac{1}{2}}T^{-1}K^{\frac{1}{2}}$. (B)

Orthodoxly, we may write the molar equation, including Newton's law, exactly analogously to (A), thus:-

$F = MLT^{-2} = M^2L^{-2}$. (C)

Hence, $M = M^2L^{-3}T^2$ . . . (D)

which is nonsensical of course, but no more nonsensical than the precisely analogous equation (B). Then, substituting the value of M given by (D) in (B), we have

$(Q_s) = (M^2L^{-3}T^2)^{\frac{1}{2}}(L^{1\frac{1}{2}}T^{-1}K^{\frac{1}{2}}) = MK^{\frac{1}{2}}$ . . . . (E)

or, $Q_sK^{-\frac{1}{2}} = M$ . . . . . (F)

We have orthodoxly, $Energy = ML^2T^{-2} = Q_s \times P_s$ (G)

Substituting for Q_s its value from (B), we have

$P_s = ML^2T^{-2}/M^{\frac{1}{2}}L^{1\frac{1}{2}}T^{-1}K^{\frac{1}{2}} = M^{\frac{1}{2}}L^{\frac{1}{2}}T^{-1}K^{-\frac{1}{2}}$. (H)

Then, in $Energy = Q_s \times P_s$, we substitute P_s from (H), and Q_s from (E) and have,

$Energy = MK^{\frac{1}{2}} \times M^{\frac{1}{2}}L^{\frac{1}{2}}T^{-1}K^{-\frac{1}{2}} = M^{1\frac{1}{2}}L^{\frac{1}{2}}T^{-1}$ . . (I)

And that result, obtained by strictly following orthodox logic and equations, is nonsensical, and is also flatly and explicitly contradicted by (G). —— We hence see that an *actual* Q_s is $Q_s\ldots$, and that K is a numerical coefficient replacing the dots. In standard One conditions Q_s is Q_{se}, and K is then 1.

c. In this paragraph I shall make a verbally consistent explicit fundamental statement of *static* electricity, analogous to the fundamental molar or static matter equations in §73fg. We have $F_r(stat.\ elec.) = Q_s(LT^{-1})Q_s'/L^2 = Q_s^2K^{-1}/L^2$. And, as a unit standard:- $F_r = M_eLT^{-2} = Q_s^2K^{-1}L^{-2}$. Or, $Q_s\ldots(stat.\ elec.) = \sqrt{(Q_s^2K^{-1})} = Q_sK^{-\frac{1}{2}} = \sqrt{[(M_eLT^{-2})L^2]} = M_e^{\frac{1}{2}}L^{1\frac{1}{2}}T^{-1}$. And $P_s\ldots(static\ electricity) = MK^{-\frac{1}{2}}L^2T^{-2} \div M_s^{\frac{1}{2}}L^{1\frac{1}{2}}T^{-1} = M^{\frac{1}{2}}K^{-\frac{1}{2}}L^{\frac{1}{2}}T^{-1}$. And $Q_{se} = Q_s\ldots/K^{-\frac{1}{2}} = M^{\frac{1}{2}}K^{\frac{1}{2}}L^{1\frac{1}{2}}T^{-1}$; and $P_{se} = M_eL^2T^{-2}/M^{\frac{1}{2}}K^{\frac{1}{2}}L^{1\frac{1}{2}}T^{-1} = M^{\frac{1}{2}}K^{-\frac{1}{2}}L^{\frac{1}{2}}T^{-1}$; so that truistically the orthodox $Q_s \times P_s$, or explicitly $Q_{se} \times P_{se}$, $= M_eL^2T^{-2} = Energy$. —— It may be noted that the standard potential P_s, or explicitly P_{se}, and the *actual* potential $P_s\ldots$, are identical (cf. §74h); and that again means that these equations are merely formal or *naming* or '*if*' equations that omit an LT^{-1}; i. e., there being actually *zero* potential, they assert no *actual* motion or energy.

d. In this paragraph I shall make a verbally consistent explicit fundamental statement of dynamic or electromagnetic electricity, analogous to the fundamental dynamic or gravitational matter equations in §74bc (repeating a little of §75c). We have as a standard or static or One unit naming, $F_{re}(dyn.\ elec.) = (mU^{-\frac{1}{2}})(mU^{-\frac{1}{2}})/d^2 = m^2U^{-1}L^{-2}$; and $F_{re}(dyn.\ elec.) = m_ec_el/r^2$; and $Q_{me} = cT$. And for actual, dynamic electrical matter or $m\ldots$'s, we have $F_r(dynamic\ electricity) = (m\ldots)(moving\ m\ldots)(LT^{-1})/r^2 = (m\ldots)(LT^{-1}m\ldots)(LT^{-1})L^{-2} = (mU^{\frac{1}{2}})(mU^{\frac{1}{2}}LT^{-1})(LT^{-1})L^{-2} = m^2UT^{-2}$. Also, orthodoxly we have $F = mclr^{-2}$; and $Q_m = cT$,—so that $c = Q_mT^{-1}$; and substituting, $F = mQ_mT^{-1}lr^{-2}$; or explicitly, $F_r = (m\ldots)(Q_m\ldots)LT^{-1}r^{-2}$; hence, as Q_m is an explicitly moving $m\ldots$ (see next paragraph), we orthodoxly also explicitly have the same "experimental" equation as the equation already derived purely verbally (i. e., by experiments or observations on words):- $F_r = (mU^{\frac{1}{2}})(mU^{\frac{1}{2}}LT^{-1})LT^{-1}L^{-2}$. I. e., our verbal truisms are now in definite agreement with orthodox "observational" equations—taking it that by correct observation K and U are *not* quantitatively constant. Then, as before, we have the general One static reference or zero point, $F_{re} = M_eLT^{-2}$. Therefore, $Q_m\ldots(dyn.\ elec.) = mU^{\frac{1}{2}} = \sqrt{[(M_eLT^{-2})T^2]} = M_e^{\frac{1}{2}}L^{\frac{1}{2}}$. And Q_{me}, *or the orthodox* Q_m, $= Q_m\ldots/U^{\frac{1}{2}} = M^{\frac{1}{2}}U^{-\frac{1}{2}}L^{\frac{1}{2}}$. And the orthodox E.M.F., or P_{me}, $= ML^2T^{-2}/M^{\frac{1}{2}}U^{-\frac{1}{2}}L^{\frac{1}{2}}$. $Q_m\ldots \times P_m\ldots = MU^{-\frac{1}{2}}L^2T^{-2}$. And $P_m\ldots = M^{\frac{1}{2}}U^{-\frac{1}{2}}L^{1\frac{1}{2}}T^{-2}$. And we see from those values that $Q_s\ldots/Q_m\ldots = LT^{-1}$; or orthodoxly, Q_s/Q_m or explicitly $Q_{se}/Q_{me} = LT^{-1}/K^{-\frac{1}{2}}U^{-\frac{1}{2}}$. —— And the same remarks about potential (cf. par. c) still apply—an LT^{-1} has been omitted, so that now the difference between P_{me} and $P_m\ldots$ is that $P_m\ldots$ is multiplied by $(U^{-\frac{1}{2}})^2$ to give P_{me}; i. e., the 'moving m' has the *purely verbal* inverse square law applied to it, and has not yet *actually* become a real difference in potential. Or, to put briefly what we see in more detail in the next section, the *purely naming* inverse square law (which is hence absolutely "explained" as being a verbal truism of naming an arbitrary splitting of the One) is applied *once* in order to name the *static* m's; *then*, the same purely naming inverse square truism is applied a *second* time *internally* in the *moving-m* or Q_m, in order to name the parts or the *dynamic* changes or internal motion of Q_m or one of those m's previously statically or 'molarly' named. That absolutely explains the $^{+\frac{1}{2}}$ (rather than the $^{-\frac{1}{2}}$) exponent of the U's in the *actual* $F_r = (mU^{\frac{1}{2}})(mU^{\frac{1}{2}})(LT^{-1})^2L^{-2}$; it is what I shall call the second inclusion or use or application of the inverse square law—a purely verbal way of making the essential cancelling of L's and T's, so that we may rigidly and honestly adhere to our agreement that $A = A$. But that second inverse square obviously still does not assert that the zero or unit or static or 'point' m actually gives or exhibits any potential. In practice, we verbally insert another LT^{-1} in the equation, and get "power" (§73h). And in order to have our really mystic point m become *actual*, and consistently *apply* to *parts* of the universe, and not be restricted to mere geometrical abstractions, we assert that U is not constant—a truism naturally in agreement with observed facts, because we started these truisms on the natural fact that bodies change. That gives 'no exact science,' and *in effect* logically *includes an infinite regress of the inverse square law itself.* —— That is to say, *actually* or *observably all* m's have *structures*—"internal motions." So when we apply the inverse square naming to the *One*, we would in *practical actuality* take some finite smaller structure as a *static* or 'molar' body of reference; *but*, theoretically and also practically in the degree in which our perception and use of the universe increases, *that* structure or smaller or unit static m *in turn* must be split, in order to be more accurate and definite—and so on ad infinitum. So we parsimoniously chop that theoretical ad infinitum *logic* (not our practical efforts to use smaller and smaller structures: cf. Part Two) sharp off by calling U variable—which obviously will logically take care of *all* splittings. —— *In practice*, we can and do take *two* points of view:- (1) we consider *ourselves* on a static body (i. e., take ourselves *in effect* static), and observe (i) static bodies, *and* (ii) moving bodies and compare them; (2) we take *our* point of view as dynamic or as moving, and observe the same two sorts of bodies. Consequently, it is obvious that we need, and do use, the inverse square naming device *twice*; we get *started* on that infinite regress of points of view (i. e., we ourselves in turn are partly static and partly dynamic, etc., etc.); but having thus *essentially* experienced how we go from parts to the larger standard whole they make or vice versa—from a structure of one *order* (as molecules) to one of a different *order* (as a molar body)—we then chop off

the remainder of the naming devices. It is a trifle puzzling at first, when stated explicitly: in implicit practice it is so simple that three-year-olds understand it so well as to *use* it fluently. I shall give a few details in the next section of just how Ampere did it in practice (see also §83). In this sharp, explicit form here that is needed by experts, the proposition is hard to see because it is stated in technical terms not very familiar except to physicists. —— But in everyday, rough terms all this is exceedingly simple:- If we want to get the energy from coal we burn the coal: i. e., actual energy consists of the coal's changing its inner structure, and *ceasing to be* COAL. If we ourselves work—*do* something,—we *partly* destroy ourselves—partly die (usually we eat some food and grow back again). Hence, when we begin to *express* or name energy, the body which actually gives the energy *ceases to be*, and then of course there is *not* any such body to name: obviously, the actuality or the reality *is* ineffable. So, what we actually do is formally to name the body as exploding or flying into pieces (so to speak), and we name those pieces as flying out in L^2, while we ourselves nominally or with tacit formality take the line of the third dimension *to* the other body which *receives* the energy. *That* body *grows* (explodes or changes itself into something else, in what we might call the opposite direction; see Index, "Growth"), or verbally receives the energy into itself by the inverse square relationship. So we end, not with the two bodies we first named, but with two bodies that in strict *verbal* truth are new, and would have to have two new names unless we used that inverse square device twice, as a *general* way of implicit double naming. —— There is no need to try to grasp all that here, in that condensed form. All that needs to be noted is that the instant we start to use language it will slip out of our positive grasp unless we devise that infinite regress of inverse square naming to *hold it.*

e. It has been observed experimentally that a moving static charge or Q_s and a moving magnet m both create what is called a magnetic field ("Ency. Brit.," ix, 216; and Art. "Magnetism"); and hence both cause a current (or, truistically with our equations, *are* a current, when "matter" is consistently defined; i. e., Q_s..., Q_m...., m..., and c... are all simply different names for matter). Ampere went *in*directly about measuring a current (Watson's "Physics," 688), and instead of getting the immediate complete statement of those observations just mentioned (I have put them in a form reversed from the usual point of view), he made an *if* statement, a complex verbal naming:- $F_r(dyn.\ elec.)=mcl/r^2$. He tacitly assumed as a context of that statement:- $F_r(dyn.\ elec.)=m^2U^{-1}L^{-2}$, and $c=Q_{ms}T$, and $F_r=MLT^{-2}$, and $Q_{se}\times P_{se}=ML^2T^{-2}$. What I did in the last paragraph was to combine *all* of Ampere's *if*'s and tacit verbal agreements into a complete single statement. I did not put that complete statement into the equation for *Energy*; that equation lacked an LT^{-1}: the complete statement is in the context—and, as we saw, more or less had to be in the context, because the Q_m or other matter, if it *did* produce *Energy*, "died," and did not any longer exist *as* Q_m to be talked about. So in the next section we see some of the details of Ampere's law—of the double use of the inverse square law in mentioning any actual energy.

§77. a. The orthodox equation $F_r=mcl/r^2$, when it talks of multiplying m and c together, actually *explicitly* asserts that it will multiply *m*ules by *c*ows—which of course is pure nonsense unless a definite proof is given that the ultimate *meaning* is merely that m and c are related as identities —that '*m*ules×*c*ows' merely *means* that both are (say) animals—that m and c are the same sort of matter. Actually, in that equational statement of Ampere's law, m is a static unit m_e that implicitly implies an unstated inverse square law, and c is dynamic zero matter c_e that is nominally distributed over the line l, and is named by the asserted inverse square law c/r^2. We are to look at that in a little more detail and from a point of view a little different from before, but essentially what we see will be a repetition of §76de.

b. Ampere explicitly asserted his law (Watson's "Physics," 688) in this form:- $F=c\times ds\times \sin A/r^2$, where ds is the length L of the infinitesimal element of the path of the current c, and A the angle made by that short part of the path with the line joining its center to a point (the center of a circle in the experiments) at a distance r, at which point the F (relationship) is measured. Now, unless that element ds is actually zero or a One (a geometrical point, or the total infinite universe), as a truism that verbal inverse square law does not hold. (If Ampere's *experiments* "show" that it does hold, then the *experimentally* nonsensical conclusions of §76b obviously must also be true; and as those conclusions are extremely easy to disprove *experimentally* and as Ampere's experiments on ds are truistically practically impossible to get accurate, forcing him to guess, we conclude that Ampere's experiments do not accurately prove what his law nevertheless formally asserts—and as Ampere is a first class man, he probably said so himself.) If ds is zero, A is indeterminate; i. e., by using a zero we promptly go into ineffable religion, where no measures are *positive*. But as we are dealing with unit measures we may call A 90°, in which case $\sin A=1$, and drop further considerations of its numerous implications—as it then has its *average effect* that is implicit in $F=mcl/r^2$. Thus we have the explicit verbal truistic agreements:- $F_s=c\times 0/r^2$. That is rigorously logical (a truistic statement of the naming principle Ampere started with, as was just indicated); but we *positively* have said nothing except that *we are going to say something* in that way or form about a c which we have not yet actually asserted or indicated, which exerts F_r on, or is related to or identified with, the body 0,—the c itself thus as yet being *positively* or in a Many sense a 0, like the other body (see next paragraph). The c has not yet been asserted to move. Hence, c is *absolutely* static electricity, or absolutely Q_{se} (there is no such actual thing; it is a verbal unit form). And if we have an actual Q_s..., we have already seen (and it is agreed by orthodox science) that we *must allow for its environment* by $K^{+½}$, and write $F_r=cK^{+½}\times 0/r^2$. (I still write it c, as we have yet to give it a velocity.) —— Now, that is in direct agreement with well known experiments on static charges, Q_s...'s. Thomson and Heaviside have shown ("Ency. Brit.," ix, 216) that $F=cV\sin A/r^2$, where c is a *moving static charge*. That equation is obviously the same as Ampere's law $F=c\times ds\times \sin A/r^2$, except that as c is *named* a "charge" the V is explicitly stated.[77b] So that Heaviside experiment

[77b] Incidentally, that Heaviside equation also omits—at least in the place cited—all definite statement of evironing conditions, thus implying a constant K; hence, its inclusion of a definite V is self-contradictory. For it is obvious that if there were *no* variation in K —no effect of the environment on c,—then simply as a truism, r, which is logically a part of the environment (or asserts that some *thing* is 'at the distance r,' so that we *mean*, by using r, that thing), could have *no* effect—could *not* have been related to r by F. —— As a perhaps important digression, that mere verbal truism of the One and Many is the solution of the controversy as to whether "action at a distance" is possible. The answer depends, as a mere truism, upon what language agreements are made—"on definitions." In our everyday language, as a truism action at a distance (i. e., between two things absolutely separate) is not logically possible, as we have just seen. *But*, if we talk an *infinite pluratism*, then no sort of action but action at a distance is possible (i. e., no two parts are ever absolutely in contact, or unseparated, as that would mean merging or ultimate identity, contradict the agreements of infinite pluralism, and revert to our everyday One language; also, cf. §97).

agrees with our language truisms to the effect that we must put an *actual* c (i. e., $c...$) in Ampere's law if we are to talk positively—thus:- $F_r=cK^{+½}\times 0/r^2$.

c. We may now explicitly assert that the $cK^{½}$ *does have a velocity*, as in Ampere's experiments, by simply writing it in:- $F_r=(cK^{½})\times V\times 0/r^2$. Next, we note that the 0 implies a standard unit body at a distance r from $cK^{½}$. Obviously, if we are to speak a positive language of finite Many terms, we now have to express explicitly an actual body instead of that formal 0 (zero). The $cK^{½}$ is asserted to be moving, the $K^{½}$ providing for any changes the environment may cause in the fixed unit standard c (c_e,—an M_e). Consequently, we truistically have to assert that c is related to—*identical* with—a part of the universe that is also moving; otherwise, we would undertake to identify *c*ows with *m*ules *as such*. That part can not of course be *actually* condensed to the geometrical point 0 at the distance r. Also, the part or body at distance r obviously must have its motion *internal*; for if the body at distance r moved bodily or 'molarly' as does c in its circular path, it would move away from the distance r, and we would have to devise a more complicated way of expressing and observing which would somewhat hide these fundamental elements of expression without dispensing with them. The sort of electricity which is that kind of matter in internal motion is a magnet $m...$ (as we saw in rigorous theory in the last section, and as we shall see concretely and intelligibly in §135). Hence, we have to name an actual $m...$ internally, by the usual inverse square law (this is the *second* application of that verbal law); we may indicate or imply that, as with the $cK^{½}$, by writing $mU^{½}$. Obviously, the *environment* of the *internal* parts of an actual $m...$ is *not* the environment *between* $c...$ and $m...$ which the $K^{½}$ took care of; so we had to have another coefficient, $U^{½}$.

d. We now have formally, $F_r=(mU^{½})(cK^{½})LT^{-1}/L^2$. But that equation is by no means explicit. It merely names two dynamic bodies (i. e., both are formally '*m*ules'):- $(cK^{½}\times LT^{-1})$ and $(mU^{½})$; but it fails to assert explicitly that there is relative motion between them—fails to be explicit about another LT^{-1}. *Also*, as $m...$ is now explicitly in internal motion (and as of course in finite language both $c...$ and $m...$ must be of finite size), an infinite regress of *additional numerical coefficients*, each implying the same inverse square truism of naming, is, *for absolute explicitness and accuracy*, required. But clearly we can not write that infinite regress. So we chop short the logical procedure by letting just K and U stand for that infinite regress and then by asserting the absolutely accurate truth:- that we can not write K and U accurately—which is the same as saying that in absolute truth they vary. We also note that we omitted one LT^{-1}, and that the *if*-name F_r is hence still an F_{se}—formal.

e. The equation $F_r=(mU^{½})(cK^{½})LT^{-1}/L^2$ is not *directly* comparable with the equations in §76bc. The difference of point of view used is obviously that here I have used a c_e (a unit point of zero *charge*) to start with, as that showed the elementary verbal laws we needed to see. In §76 we used m's; and c is obviously only *one* of the internal parts of an m (see XIV). Consequently, our equation here is merely an outline of the verbal foundation of $F_r=m^2U^{-1}L^{-2}$. The last paragraph explicitly asserts and describes that primitive condition of our present equation. I have formulated this primitive equation because it serves to show fairly clearly a number of verbal relationships that are too much concealed in the more explicitly complete equations in §76. The present equation is merely tentative. An indefinite number of other ways of writing the equation to show those relationships are possible. I am not satisfied with the way I use; the physical mathematician ought to have a considerable volume of more careful and explicit discussion of these forms and application of this matter which I must condense into the present section. Such a treatise would show that I am forced into vaguenesses and unprecise statements in order to get brevity.

f. It is obvious that the second verbal introduction of the inverse square law into our equation means that a *change* from *c*ows to *m*ules was made; one *standard* One (a formal universe of things named '*c*ows' or *c*—things moving bodily or molarly) was translated or changed into another standard One (into a universe named '*m*ules' or *m*—things moving internally; i. e., which were verbally split up some more; or, what is the same, were split *differently* with respect to the total universe). In short, *m* and *c* are typical of *any* two bodies expressed each by a *property* different from the other; and that equation is the *explicit* type of physical equation that permits and asserts their *measurable* (i. e., definite, *explicit*, "scientific") comparison. Clearly, the explicit *method* of splitting things differently, or giving them different "properties," is named *motion*, and is otherwise expressed by or as time and space (i. e., is the LT^{-1})—method, motion, property, time, space being obviously "abstractions," or what we more precisely call relationships, all of which are ultimately identical. —— And the explicit numerical or "measured" or "scientific" connection or unification thus given to all knowledge is at once obvious from the equation, thus:- The unit or standard *m* and *c* were mere monistic or mystic *names* to be expressed inversely as the distance L^2, in infinite regress. Those names then were simply the verbal "framework" or logic of a *possible* explicit expression or assertion about two actual bodies of different properties, thus:- mc/L^2=*a unit force or relating-into-a-One of any value* (i. e., a numerically indeterminate quantity). Then, when we wished to make that abstract formal unit actually a unit or 1 in agreement with our average positive speech of finite parts like yards and pounds, I inserted a more explicit expression of the infinite regress:- $U^{½}K^{½}\times LT^{-1}$. (The two parts of that expression are themselves implicitly cancelling—as we have seen repeatedly. I. e., it is a truism, equivalent to our $A=A$ of §22—which is the ultimate proof and explanation of the equation.) Hence, in average conditions, or in our inaccurate mutual positive finite Trinity language, we have $U^{½}K^{½}LT^{-1}=1$; or $U^{-½}K^{-½}=LT^{-1}$.

g. The theory of translation—the fact that all science is unified—is thus complete, rigorous (as being merely truisms), and ultimately final (i. e., the universe itself is the standard, and no changing part such as man, or our comparatively little earth). To get, in any case, the actual measures of the things we thus unify, we simply go and measure.

h. I have been calling our bodies 'static' and 'dynamic,' depending respectively on whether a given one was considered as a 'whole,' "rigid," or "molar" body, or as a body that explicitly was internally in motion. But a static body *has in general effect*, and also formally, a surface zone of substance at V_1; and a dynamic body consists of parts, each of which has such a zone, with a tacitly static interior to that part like the interior of a molar body (for explicit proof see Part Two). Consequently, a 'static' body is *not perfectly* static (i. e., the moving zone extends into the insides some); neither is a 'dynamic' body perfectly dynamic (for the insides *of its parts* are tacitly static). The fact that the coefficients represent an infinite regress of variable motion obviously provides truistically for those actual variations from *perfection* or formally statable exactness. Furthermore, it is obvious that a part of the dynamic body has substantially the same zone velocity (V_1) as the difference zone or surface of the static one; consequently that part (with a negligible *static* insides; cf. §98pw) can unite with the

moving zone of the static body, changing the velocity of the whole molar body, while the dynamic body partly passes out of existence as such. Hence, our formal expression is ultimately consistent. As an incidental point, our use of 'static' is obviously equivalent to the conventional "potential energy," and 'dynamic' to "kinetic energy." Clearly, therefore, "potential energy" does not assert any absolute non-existence of motion; consistently, it merely means that the body is verbally static. I shall not go further here into those obvious details of formal speech.

i. That formally completes the theory of electricity, unifying it with respect to itself, and unifying it (according to the whole of this chapter) with other branches of science. In XIV we revert explicitly to electricity, using Ohm's law as a concrete method of unifying the actual mechanics of electricity with this general statement of the valid mathematical or verbal theory of the expression or measurement of electricity. We ought to know definitely what *measurement* itself is before we go basing science on "measurement." There is no more merit in the shibboleth "measurement" than in the Scholastic ones "Essence," "Substance." We have seen that Newton and Ampere fancied they were measuring; however, as a matter of fact, they mostly merely matched their skill with some verbal truisms.

---

§78. a. The orthodox summed statements (i. e., the orthodox fundamental equations) of the ways of naming or measuring *heat* consist in assertions of agnosticisms and then assertions of gnosticism. E. g., Watson's "Physics" says in effect (p. 344) that J and H (which are our heat names or quantities that are really analogous respectively to the pairs of coefficients C and G, and K and U;—I use H instead of the usual Greek θ, the final straw deciding the change being that I couldn't buy the Greek type in Boston except by having it made with a delay of a month) have unknown "dimensions." But Watson then explicitly makes a guess at those dimensions; also, he and other orthodox physicists, even in the state of admitted or tacitly admitted ignorance go right ahead and *use* J and H in explicit equations—the very doing of which of course truistically implies definite knowledge of them.

b. Consequently, it truistically follows that I am unable to say positively just what the orthodox theory of heat does assert—ultimately, to say what any orthodox theory asserts: for all actual Many units at least tacitly involve heat conditions. We simply have to sum it up that orthodox science asserts its incompleteness. So we are seeing how to complete it. And it is an unessential quantitative problem as to just where conventional science stops.

§79. a. Joule and others found that a certain amount of molar motion is equivalent to a certain amount of heat under certain conditions; e. g., he found that in his latitude in about average weather the energy that would lift about 772 pounds one foot would raise the temperature of one pound of presumably pure water from 59° F. to 60° F. That equivalence or transformability of heat and molar motion or "energy" is called the first law of heat, or of thermodynamics. The law is expressed (Watson's "Physics," 342-5) in the equation $Energy=Q_hJ$, where Q_h is unit quantity of heat (explicitly, in our abbreviations, it would be Q_{he}), and J is orthodoxly the "mechanical equivalent of heat" and a constant (but *validly*, it is a variable numerical coefficient applicable to 'molar' or 'static' bodies of heat). The thermal unit Q_h by orthodox definition depends upon the mass M of water heated, and upon the "unit" (involving H) of temperature taken; or, $Q_h=MH$. Hence, J truistically depends upon the temperature scale, whose dimensions are implied or indicated by the H (because fundamentally $Energy=Q_hJ$ and also $=ML^2T^{-2}$); and H is said to be of unknown dimensions so that validly J orthodoxly must logically be unknown and unusable. Watson says that perhaps $H=ML^2T^{-2}$ (i. e., probably is *Energy* itself). Lamor, an authoritative mathematical physicist, states positively and, so far as I can determine, without reservation ("Ency. Brit.," xxii, 806):- "The temperature of a gas is measured by the mean energy of translation of its molecules." Expressing that in orthodox equational form, we have $Temp=\frac{1}{2}mV^2\times$ *a constant*; or $H=ML^2T^{-2}=Energy$. —— However, regardless of what H orthodoxly is dimensionally, orthodoxly $Q_h=MH$.

b. From the two orthodox equations, $Energy=ML^2T^{-2}=Q_hJ$ and $Q_h=MH$, we have directly, by ordinary algebra, $Energy=Q_hJ=MHJ=ML^2T^{-2}$. If in that we substitute the orthodox presumptive dimensional value of J, $J=ML^2T^{-2}$, we have $(MJ)ML^2T^{-2}=ML^2T^{-2}$—which (if explicitly interpreted) is obviously self-contradictory nonsense.

c. If we take that equation, $Energy=Q_hJ=MHJ=ML^2T^{-2}$, as it stands and consider that it actually means or implies something (and it certainly is self-consistent in its usual interpretation, so far as that interpretation concerns approximate measurements or experiments—which are apart from conventional scientific theorizing as to what temperature and entropy are, which is atrociously irrational and puerile), then it obviously must assert one of two general statements:- (1) The equation may assert that J and H are numerical coefficients, each *implying* an LT^{-1}, so that $H_eJ_e=(LT^{-1})^2$, and $MHJ=ML^2T^{-2}$,—which makes the equation a truism (identically as in §77), and gives us $H^{\frac{1}{2}}J^{\frac{1}{2}}=LT^{-1}=V$. In that case $J^{\frac{1}{2}}H^{\frac{1}{2}}$ corresponds identically with $CG^{\frac{1}{2}}$ and $K^{-\frac{1}{2}}U^{-\frac{1}{2}}$; and we see at once that these heat equations imply the same facts as all other valid equations, but orthodoxly have merely omitted explicit statement of the verbal processes of naming. (A quick proof of that, which of itself rigorously proves our total argument, is this:- The inverse square naming law orthodoxly is omitted twice, amounting to the fourth power of any single coefficient. Hence, radiant heat, which implies a dynamic heat, should vary *approximately*—since the coefficient is *variable*—as the fourth power of such a coefficient. And that actually is experimentally what is known as Stefan's law ["Ency. Brit.," xiii, 155]. In the experiments that *variability* is very perceptible.) (2) Or we can take the equation in an orthodox interpretation:- that H and J are some sort of *constant* values. In that case $JH=L^2T^{-2}$; and as a truism, J *and* H must be fundamentally identical with L *and* T—a conclusion which in effect asserts that all of orthodox heat is religious or mystic language, and that a positive finite or scientific language is impossible; or else it drives us to the theory of relativity. As a matter of fact, this second interpretation asserts that relativity theory. In that sense, our equation is an explicit assertion of the infinite regress (to speak everyday language) that applies to any Many part; or is an explicit assertion of no exact science. —— So again, by the only other interpretations of the equation that were possible, we have a rigorous general proof of the validity of the unification made by this book.

d. Therefore, (1) we are forced to drop any orthodox view that J and H are physical "constants" (unless we revert to relativity), and to take it that they are variable coefficients like K and U, etc. And (2) if the actual direct measures that have been made of H and J be noted (those for Stefan's law are indirectly such, e. g.), it is obvious enough that they vary. —— Those two points therefore complete the essentials of the measuring theory of heat—show how to write M(*varying with*)L^2T^{-2} in heat terms. The

H and J really *belong together*, as was shown in §77 to be the case with $K^{-½}U^{-½}$. The reader who is interested may readily see for himself the details of how $MJ^{½}$ expresses static ("convective") heat matter, and $MH^{½}$ expresses dynamic ("radiant") heat matter, and get the consistent dimensions of them. He will see too that orthodox equations really assert that Q_hJ, MH, and M are all "matter," and that the inconsistency and agnosticism of orthodox equations lies in their omission of statement as to just what kind of matter each is—i. e., omission of the naming inverse square. Consequently, as we see in the next section, when heat theory or naming undertakes to translate from the *measuring* member $M(varying\ with)L^2T^{-2}$ into the One member *Energy*, or into the everyday naming member *That*...×*This*..., it gets confused. The actual fact is (cf. (2) in par. c) that orthodox heat is mostly engaged simply in writing what are substantially truisms of the religious member:- *Energy*=*Energy*. E. g., *Energy*=Q_hJ immediately implies such a truism, in so far as it explicitly has any rational meaning; and so does $Q_h=MH$; and so does the vague, aspiringly tentative equation $H=ML^2T^{-2}$. Aspirations are for children and second class poets: adults, and especially real scientists, achieve.

§80. a. It therefore is obvious that conventional heat is substantially not science at all, but religion. The first law of heat, *Energy*=Q_hJ, is mostly an observational statement of the religious law of conservation of energy; the poets back in the mist of antiquity said the same thing with more extensiveness, but less intensity and direct verifiability, when they said that all things unite into the One.

b. But for the past fifty years there has been an effort to make heat scientific—express it in pluralistic terms, or definitely in terms of L and T. The difficulty was, as we shall see, that heat from our usual point of view consists of *unsystematic* splittings of bodies—which unsystematic parts were readily perceptible. In short, in heat so many variations were perceived that it was difficult to make short, consistently mechanical or logical statements of them, and there was a tendency to bunch them religiously. When the so-called science of heat tried to make a pluralistic statement of itself, it intuitively followed everyday usages at first, and attempted to split heat into *That*...×*This*.... If it had been done fairly correctly, the resulting pair of factors would obviously have been similar to the $Q...×P...$ in electricity, or $F...×L...$, etc., and the last section (which formulated the measuring member for heat) would have amply covered the theory for the purposes of this book. It however unfortunately happened that a German, materialistically inclined and hence with no actual grasp of the principles involved (a physical science highbrow, in brief), Clausius, undertook to make heat a science ("Ency. Brit.," Art. "Clausius***"). And Clausius messed up heat about as thoroughly as it could have been done (the mess passes from the ridiculous to the sublime), and concluded with a nonsensical second and last "law of thermodynamics"—which is usually put into the form of a strange generality called the "*increase of entropy*," which temporarily had as blighting an effect upon science as its sociological analogous nonsensical generality, aristocracy (or the "increase" to infinity of a part of mankind) temporarily had on society. We have to examine Clausius's rather confusing mess here from the present point of view of mere scientific naming of observed $M...$'s. We obtain the same valid principles, in familiar and more intelligible terms, in §§100, 140, 153, etc.

c. The thing which Clausius substantially did (stripping it of all its confused technical verbiage which poor little schoolboys are supposed to be able to understand), is this:- He combined the two approximate, observed equations *Energy*=Q_hJ and $Q_h=MH$ into the equation (which is still monistic), *Energy*=MJH. Then, instead of seeing what that actually meant, he substantially said that H is a quantity that is temperature, and *Energy*/H, or MJ, is a quantity that is entropy—so that *Ent*×*Temp*=*Energy*. However, he could not assert any such *quantitative* equations as MJ=*Ent*, or H=*Temp*, as the perceptible variableness of what are actually mere numerical coefficients would keep those equations from being quantitatively reasonably accurate except at standard zero conditions, and therefore such assertions would lead to obvious self-contradictions when H and J were orthodoxly taken as constant. So he named temperature not H, but *Temp*, and said *Energy*/*Temp*=*Ent*. But the verbal forms of expression he used or assumed in thus attempting to get a *That* and *This* (namely, *Ent* and *Temp*—instead of an *actual That*... and *This*..., or *Ent*... and *Temp*...), may obviously be considered to be these two:- (1) He misinterpreted the first law of heat, *Energy*=Q_hJ, to the pure dualistic effect that the total *Energy* which corresponds to the Q_h is absolutely independent of the temperature of the body containing the heat: i. e., J is constant, or the equation *Energy*=Q_hJ is taken to be *completely explicit*, and because it fails to mention *Temp* explicitly, therefore it is true of any temperature. (2) He then held that the equation $Q_h=MH$ was also completely explicit, and that it, on the other hand, asserted that when we have to consider the actual conversion of that heat Q_h into *Energy*, then the temperature of the body containing Q_h (which body is the 'residence' of Q_h) is asserted by H, and hence that temperature has to be taken into account. That second view is one way of stating the second law of heat: the equation $Q_h=MH$ is tacitly supposed to represent the law. —— Of course you can't undestand those dualisms if you interpret them strictly. I am implying that they are nonsensical, and from that point of view they are more intelligible than Lamor's dualistic remark (§79a) or the orthodox mathematics ("Ency. Brit.," xviii, 658), that are openly dualistic.

d. Those two interpretations of the *That* and *This* (no dots) which he got for heat under the names *Ent* and *Temp* are clearly self-contradictory;—for obviously Clausius says (as the first law) that heat-quantity or 'weight of heat' or entropy resides as a second entity on a given entity or molar M and is independent of the temperature or *Temp* or potential of the body (which is a materialistic assertion of dualism); and then he asserts (as the second law) that temperature does have some effect. —— The first law of heat, in that orthodox form, is clearly merely an *incomplete* attempt to pass from a monistic truism *Energy*=Q_hJ, to positive or pluralistic language by making a formal agreement to divide the universe into static parts or M's of heat. If properly (i. e., completely) expressed, such a verbal agreement or law is necessary for science, as we have repeatedly seen. But Clausius's way of solving that One and the Many in its heat guise is merely the customary German professor's invalid dualistic, materialistic way:- he logically or formally keeps on having absolutely independent universes, or *That That That etc.*, explicitly as *Ent Ent Ent etc.*, which never combine into a meaning or a real universe—although he obviously just the minute previously had *started* from a real One. Therefore, apparently being intuitively suspicious of his first law as he stated it (as was quite natural, it being nonsensical; and also because it was difficult to have such a short memory and forget so extremely quickly that One or *Energy* which he started with), he proceeded flatly to deny the first law in the second, with the natural result that it also is nonsensical, as we now proceed to see.

e. The difficulty he directly had with the second law resulted from the fact that he tried to use *Temp* or temperature surreptitiously (even with respect to himself) as being all three forms of the Trinity, in order to compensate for the shortcomings of the first law in dealing with the One and Many. Perhaps chiefly he used *Temp* as a relationship word (as $Temp_r$, corresponding to L_r) to assert L (and T) as binding his *Ent Ent Ent etc.*, into a universe; consequently, as a formal truism of valid logic, we have $Temp_r$ disappearing or *becoming zero* in the sense that it is *not* a Many part; and as *Ent Ent Ent etc.*, is all that is left *as* Many parts when temperature thus disappears, then *Ent Ent etc.*, "increases" until it is the universe or "infinity." But the second law also says in effect that *Temp* is $This_e$—a standard unit or One, on which as a formally fixed base the whole science of heat starts (for details, see next paragraph). And still further, the second law asserts that *Temp* is *This...*; obviously, in all applications of heat equations to actual circumstances *Temp* is a changing *This...*. Therefore, Clausius, in his confused way, took *Temp* as actually *Temp...*, and asserted that all *This*'s became zero and the universe became all *That*'s—entropy increased to infinity,—which is some more obvious and glaring nonsense. —— That error was clearly due primarily to fancying that *MJ*'s could be distinct or absolutely separate, while at the same time a One *Energy* was asserted—that $A=A$ and *A does not*$=A$. Therefore, that "increase of entropy" is the typical technical error of all formal dualism, classic logic, or scientific materialism. The materialists chase the 'series' of *That That That etc.* until they become mentally desperate, and finally assert that those *That*'s are the universe BECAUSE *there are so many of them.* It is the same infantile way of talking, and narrow vision, that causes a child, when he sees (say) twenty cows in a field and is not able to count to twenty, to say that he sees "a whole world of cows." As a monistic or *admittedly* poetical way of talking it is quite permissible and intelligible, being logically the way in which a hen with more or less successful results talks to her chickens. The materialists should not, however, claim that that way—or as they prefer to put it, "the increase of entropy to infinity"—is definite, or positive, or "cold fact," or "scientific," as it glaringly is not, according to usual meanings of words. An ample logical refutation of such dualism or materialism is that if entropy increases, then there are no facts or agreements which limit the past age of the universe; hence it is logically sound, especially by the classic logic, to assert that already there has been infinite time, and entropy has *now* increased to infinity, and all temperature or temperature differences have disappeared or become zero—which obviously is not so.

f. Clausius tried to make *Temp* a One (in the same sense that orthodoxly it is guessed that $H=ML^2T^{-2}=Energy$)—that being his vague way of asserting *dynamic* heat, instead of using the valid way of inserting the inverse square law a second time. When we say a body has a temperature we mean, in an explicitly measurable sense, that the whole inside of the body is considered to be divided into parts in some way, and that that 'motion' or division inside the body causes the whole to expand or contract or otherwise (as a truism) change "properties" or splitting, in some perceptible measure. ('Temperature' in a man is indicated by calling him energetic, active, strenuous; entropy, by calling him enduring, persevering, hard-working, reliable. Obviously, *some* of each of the two factors must be had by a man even to exist—to say that his endurance or entropy increases to infinity, while at the same time his activity or potential or actual use of that endurance becomes zero is to say that the man ceases to exist: is "nonsense," if we say the *man* has such possibilities.) —— So when temperature is asserted we are dealing with a 'dynamic' body, precisely like a magnet in principle. And to say that $H=ML^2T^{-2}$, or that *Temp is* that body is valid as a religious or mystic truism, but is logically wrong if we are professing to talk scientific language: for "*temperature*" then should be the second implication of inverse square that is the way of saying that the body is a particular sort of M (or, is wrong because *Temp* and *Ent* are irrational factors [§71g]: each is utterly meaningless unless supplemented by the other, just as it would be nonsense to talk of a man highly strenuous but whose strenuous *activity* would not endure for an instant). However, Clausius decided that because *Temp* was sometimes used to *imply* a body or an entity (was what I name *Temp...*: when we talk of strenuosity we *imply* a man, etc.), then (as a conclusion; and this is also one conventional way of stating the second law):- heat can not pass from a cold body to a hotter one (because, by tacit *orthodox* truisms, the cold body relatively to the hot one has zero of the *entity Temp...*, and can not give what it, relatively speaking, does not have). Obviously, those tacit orthodox truisms are quite irrelevant (as they also tacitly assume the erroneous view that *Temp...* can be used intelligibly entirely independent of its completing irrational factor *Ent...*). As a matter of actual fact, if the reader will strike a match he will see that pseudo second law violated; for heat then passes from relatively cold bodies—the original match tip and the air about it—to the things in the neighborhood of the then ignited match. Actually, what that second law will validly assert is the abstract truism (which completely applies to no *actual* body in the universe) that from a low potential a higher one can not be obtained: it is *logically* equally true that from a *high* potential a lower one can not be obtained, as potential with reference to actual bodies is a relationship word, and is not subject to comparison. The materialists erroneously assume, as the practical fact, that a dynamic body has a perfectly homogeneous potential—that *all* of it has, at least approximately, a steady constant motion or temperature (Maxwell's demon is a theoretical speculation to the contrary). We have seen here in general that the error is due to their omission of the verbal inverse square laws: we shall see repeatedly in Two and Three that no body has any such constant potential, but that *all* actual bodies in principle have internal potentials that vary from 0 to ∞. As an equivalent statement of that, we may put the foregoing materialistic pseudo-scientific confusion of One words and relationship words that is usually called the second law of heat into familiar everyday terms:- (1) a baby can not be born, as his potential or ability to move about for a longer time is greater as an average than the biological potential of his failing parents; (2) or, "To you from failing hands the torch we throw" is, according to that second law, a nonsensical expression, whereas all intelligent people can observe directly, without all this present talk, that it is not nonsensical; (3) or, those materialists assert that growth, and birth, and radioactivity, and electron formation are impossibilities, as in such cases the potential or temperature "increases," at least locally. We shall see just how matter is made, and what growth and birth are (Index, "Growth," "Secondary whirls," etc.). Then these formalities will become easily intelligible. These facts and this argument are important to you:- all the engines which supply you with many needs are applications of them, and require clear thinking about them; and even safe experimenting with the "strenuous life" requires such clear thinking. Also, I have just performed a major surgical operation on the materialistic mind; it may not recover; but at least it can no longer infect the rest of the world.

g. It therefore obviously follows that the way in which temperature should have been measured or defined is precisely the way in which electric potential was. Hence we may write the combined static-dynamic heat equation:-

$Ent\ldots\times Temp\ldots=MJ^{½}H^{½}L^{2}T^{-2}=Energy(general\ heat)$.

Or, if we wish to consider that we handle heat in quantities such as molar bodies, in agreement with the monistic truism $Energy=Q_{h}J$, thus permitting *all* the standard One which is included by the equation to become *formally* the same temperature, we have the 'static' heat general equation:-

$Ent_{s}\ldots\times Temp_{s}\ldots=MJ^{½}L^{2}T^{-2}=Energy(static\ heat)$.

And the corresponding general 'dynamic' heat equation is:-

$Ent_{m}\ldots\times Temp_{m}\ldots=MH^{½}L^{2}T^{-2}=Energy(dynamic\ heat)$.

h. Those equations (provided we write them as unit standards, $Ent_{e}\ldots\times Temp_{e}\ldots=ML^{2}T^{-2}$, etc.) are the valid forms of the well known equations for the pressure p and volume v of a gas. The orthodox form of the static equation is $pv=a\ constant$,—which "constant" is obviously a standard One or *Energy*, so that logically or dimensionally (but not numerically when usual conventions of measuring are used) the equation is $pv=Energy$. That is called the isothermal equation, and is represented by an equilateral hyperbola. The orthodox form of the dynamic equation (the last being static) is the "adiabatic" equation $pv^{k/c}=a\ constant$ (Daniell's "Physics," 394f; "Ency. Brit.," xxvi, 809f). We take up those gas forms of scientific equations in §§82-3.

i. We may now explicitly observe (it is something of a repetition) that the fundamental difficulty in those orthodox heat confusions was as to the way to use the same language to go from statements about static bodies to statements about dynamic bodies. The equation $Energy=Q_{h}J$ implies 'molar' or static heat, and $Energy=MJH$ implies dynamic heat. The theory of the transition, which is a matter of verbal form, is identically the same as already seen with respect to electricity, etc. I must at this point omit the volumes of details which would be needed to give a reasonably full application to heat. But as an introduction to the pv form of the same verbal puzzle (which we need to consider), I shall restate a general solution in the remainder of this section, from the useful point of view of what is called the "absolute zero" of temperature.

j. In the equation for static heat, $Energy=Q_{h}J$, temperature (in the sense of *internal* division of a heat-mass, or $Temp_{r}$) is not mentioned; and the same thing applies to $Ent_{s}\ldots\times Temp_{s}\ldots=MJ^{½}L^{2}T^{-2}$ —i. e., that explicit static equation actually has zero potential, and hence no actual $Temp_{r}$ is *explicitly* asserted to exist; it of course has the symbol $Temp_{s}\ldots$, but that symbol is identical with $L\ldots$ in the general $F\ldots\times L\ldots$, and as such means merely that in an actual thermometer the thermometric or heat-containing substance stands at that height "L" or $Temp_{r}$. In that sense, the explicit static heat equation makes a statement which is true at a *formal* absolute zero of temperature (and *if* there were no variation in J, would be true at *any* temperature—but there is a variation). That is to say, so far as the statement goes, there is *no* motion or zero internal motion in the $MJ^{½}$ (or in the $Q_{h}J$). And that *formal* agreement as to *how* the universe is to be divided—the $MJ^{½}$ obviously implies an inverse square,—is the total meaning of such phrases as "absolute zero," whether the phrase refers to a potential called *temperature*, or to any other sort of potential. In Many terms—in actual, everyday nature as we commonly speak of it,—there is no such thing as a zero of temperature, any more than there is an infinity of temperature: it is an absolute truism that it is impossible to have either, *in a Many sense*. The *total* universe is at zero temperature or at infinite temperature, just as we prefer to say. But no *part* of the universe either is, or can be. As a curious fact (which again shows the consistency of these truistic statements), the theory of relativity, having completely capsized our language, asserts that there can be no velocity greater than the velocity of light in our neighborhood (but cf. XIII, XIV). That relativity conclusion, if expressed in heat terms, asserts that at the velocity of light there is an absolute infinity of temperature—an absolute maximum. So if a flame gives light, some portion of the flame is, by that theory, at infinite temperature. And that, truistically, is valid. The complete facts are (as we shall see repeatedly in Part Two) that at some place in it, every natural structure or body is *always* growing or else breaking down; at that place, where respectively either the part's neighboring parts are ceasing to be, or else the part itself is ceasing to be (*as* or in its 'original' structure, of course), the temperature or potential is obviously either zero or infinity, depending on the point of view of naming it:- if a structure is viewed as going out of existence, its "temperature" is "zero"; but at the same (really geometrical point or zero) place and time its *neighboring* structure is coming into existence, and *its* "temperature" there is "infinite." But, as the structure does not exist when it has thus broken down, or is not 'coming into existence' when it does exist, clearly it is a verbal self-contradiction to say that any *Many part* can have either a zero or an infinite temperature. That is obviously merely the problem, in terms of "measuring" or of heat or of *any* potential, of What is a number? (see discussion of the zero-infinity line of Fig. 54c, which is analogous to these *limits*).

k. In a way precisely analogous, the dynamic heat equation *formally* asserts temperature—whereas previously zero temperature was asserted (last paragraph). Therefore, speaking precisely, *if* we assert that either the static or the dynamic equation is absolute or is absolutely *expressed*, then the dynamic equation asserts an infinite temperature, for the simple reason that the only way to make a zero temperature become some other temperature is to multiply it by infinity (and that really amounts to saying that the One named zero is the One named infinity—and we actually get no definite potential that way). —— The mechanical or concrete facts that explain that verbal One and Many difficulty which orthodox science fails to get out of, are those given at the end of the last paragraph.

l. That verbal One and Many contradiction which infects all conventional discussions of potential from their very start with the obviously self-contradictory idea "potential energy," is completely obviated by noting that neither the static equation nor the dynamic equation is completely expressed (or valid) if considered to be absolutely separate from the other (which is equivalent to the fact in §§73h, 77d that there is actually zero potential in our 'static' and in our 'dynamic' equations). Actual or Many expression of finite temperatures is obviously *implied* in the orthodox One truism, $Energy=M_{c}JH$; and is explicitly given in Many terms in $MJ^{½}H^{½}L^{2}T^{-2}=Energy(heat)$:- for in such a combination we have neither the 0 of the static nor the ∞ of the dynamic. The *practical* way of avoiding those formal zeros and infinities is of course to consider that (say) $MJ^{½}$ always has a numerical value of $J^{½}$ which agrees with the *actual* relations of $MJ^{½}$ with the omitted but necessarily implied $H^{½}$ (and that is a mathematical proposition the fairly good statement of which would require volumes of differential equations, omitted from this book; I call it the theory of *harmonic proportions* or of *harmonic periodicity*, as it is the principle or quantative relationship of ratios, or *explicit* writing of the definite expansion of $That\ldots\times This\ldots$, on which the periodic table of elements is based; see Index). Until

we came to heat we tacitly considered that the static and the dynamic equations always belonged together: that view was the total unification of science in the form $K^{-½}U^{-½}=V_1$. But because Clausius in heat explicitly made science in actual effect chaos—disintegrated and disrupted it logically with German thoroughness (not out of "bad" motives, but merely through coarseness or dullness of comprehension of principles resulting from having a mind overburdened with unassimilated details or "material facts"—most of which in such cases aren't "so" anyway, being too inaccurate),—by splitting H and J apart and asserting that they were absolutely independent, even to the preposterous extent of "increase of entropy," it became needful to be explicit about their unity.

m. It hence follows that a zero or an infinite temperature (or any other potential:- chemical, surface-energy, space-molar-location, etc.) simply implies the 'surface' or zone between two parts into which a One is split—asserts the existence of a 'difference surface,' across which smaller parts of one body pass as it changes or 'moves' into being another, the first body diminishing or dying and the second (which is the first transformed) growing or being born, with "energy" being "evolved" as the process. The potential of any actual finite body can not therefore be that formal *limiting* potential, but is measured from that limit in *either direction*—one direction being called growth or increase, and the other dying or decrease. *Death* is the biological term for zero temperature, and *birth* for infinite temperature; obviously there can be no such *entities* or Many parts, nor can any actual finite Many part attain such an *absolute* condition or relationship; birth and death are, with reference to any *part* of the universe, merely quantitative, or matters of degree, and not absolute. We shall see the concrete details of this subject from time to time (Index, "Birth," "Death," "Growth," "Potential," "Difference surface"). Incidentally, the same principles of potential apply to the problems of good and evil, the structure of the solar system and atoms and man, personal immortality, etc. I have here merely stated the rigidly formal solution of those problems, in conventional physical terms.

§81. a. We have thus seen how Clausius became confused in trying to make science of heat. Substantially his was the everyday or technically philosophical way of splitting *Energy* or *Universe* into *That...*$\times$*This...*. The more specifically "scientific" way would have been to write heat energy in terms of the measuring member, as indicated in §79.

b. Hence, it has appeared that in conventional heat the everyday commonsense form or philosophical form *That...*$\times$*This...* is ordinarily used. As that everyday form is used to a considerable extent in other branches of science, we need to complete this formal unification of science by a more explicit consideration of that *naming* or philosophical member.

c. We are going to find that Richards, by completing the theory started by Van der Waals, has explicitly and with complete generality stated a unified science in the everyday or philosophical form *That...*$\times$*This...*. And as all other branches of science are already expressed in terms of *Extensive factor...*$\times$*Intensive factor...*, and as it is commonly understood that *Intensive factor...* or intensity or potential is included in complete orthodox statements of *Energy* (and that it rather consciously implies L and T), it follows that because orthodox science accepts Van der Waals's and Richards's conclusions, it in effect already accepts the unification of this chapter—provided I show that those conclusions agree with the chapter, as is easily done.

§82. a. The conclusion which Clausius gets, and which is in agreement with the dualism of the classic logic, is that in *Ent*$\times$*Temp*, *Ent* is an entity of some sort which is absolutely separate and distinct from another entity of some sort, *Temp*—and vice versa. And in agreement with that, the orthodox 'static' form of *Ent*$\times$*Temp*=*Energy* is pv=*Energy*. Orthodoxly, pv is equal to a "constant," but the constant is obviously a standard One. Explicitly, the constant is *RTemp*, where R is a constant number, and *Temp* is, like H, orthodoxly confusedly given the (dimensional) meaning *Temp*=ML^2T^{-2} (but I do not need to repeat our heat discussion to show that *RTemp* is actually *Energy*). And the customary 'dynamic' form of *Ent*$\times$*Temp*=*Energy* is $pv^{k/c}$=*RTemp*=*Energy*. (The same remarks as to *RTemp* again apply. Also, k and c are orthodoxly taken as *constant numbers* derived from experimental measures, so that $R=k-c$, etc.; see Daniell's "Physics," 370.)

b. Thus, in the $p\times v$ expression, the p and v have to be absolutely distinct in order to agree with Clausius's theory of heat. I. e., in conventional formality, the p and v are *explicitly* without the dots—are a dualism which older orthodox theory holds will sharply and accurately make up at least a standard universe: concretely, will accurately describe any given quantity of gas. But at just that point the total equation of pseudo, dualistic laws falls down completely and fails to agree with observed facts. For a sharp $p\times v$ agrees with what is called a *perfect* gas—one in which truistically the volume and the pressure vary with perfectly steady mutual proportionality. A perfect gas of course is merely an assertion of a real One: we saw Clausius starting with it (§80cd). So here it inevitably bobs up again—and fails glaringly to agree with observed facts about any *parts* of the universe. Quite naturally it would: we have seen repeatedly that *as a truism there are no perfect parts* (Index, "Exact"). The observed fact that there is no actual perfect gas is clearly a verifiable proof of the general argument of this book.

c. In short, the orthodox, "constant" form pv is neither in quantitative agreement with observed facts, nor *formally* consistent. Or, what is truistic with that:- all factors, such as $F\times L$, $W\times A$, *Ent*$\times$*Temp*, are mutually interrelated; they are explicitly *That...*$\times$*This...*, $p...\times v...$, etc., and each factor (such as *That...*, $v...$) is absolutely unintelligible or irrational if considered alone—and so on, for all the other conclusions we have already seen: they reject materialistic, perfect-gas science, and assert the fundamental law that mass varies with velocity, or assert no exact science.

d. Now, Van der Waals (in remarks written by himself, "Ency. Brit.," vi, 846) finds that instead of the orthodox sharply separated p and v, written as pv, we must write $(p+a/v^2)(v-b)$=*RTemp* [or, =*Energy*], in which a and b are usually taken as constant numbers, but not necessarily so. If constant, then Van der Waals's equation is obviously equivalent to $p...\times v$; i. e., $p...$ varies or is an actual Many part, but v (without the dots) is "perfect" [which latter is nonsense]. If a and b are not constant, then the equation is rational and valid, being explicitly the form $p...\times v...$. On the page cited Van der Waals states that "we are still perfectly in the dark" as to the principles on which his equation is based. Substantially, the equation is a fundamental modification of the *old* kinetic theory, as we shall see (§§89, 93-4, etc.), and as he himself clearly implies on the same page. But he fails to be definite about it, so far as I can find.

e. But Richards, basing his conclusion on a long series of unusually careful and skillful measurements of substances (Faraday lecture, 1911, printed in "Jour. Chem. Soc.," v. 99, and "Science," Oct. 27, 1911), finds definitely that all volumes v, even including explicitly atomic volumes, are variable; and hence that it is irrational ever to speak of a "perfect" v—one whose value is in any way "independent." By actual, direct measurements he finds Clausius's theory or

the perfect-gas theory (par. a) finally untenable so far as is now perceptibly measurable. Then Richards explicitly takes the step at which Van der Waals hesitates, and definitely asserts that the old kinetic theory, which is the "concrete" or mechanical, guessed-at base of the orthodox theory of heat, is untenable. And that amounts to Richards's saying and to proving directly even with respect to atoms, that the valid physical equation is $p...\times v...=Energy$. In order to be completely explicit and logical, we add to that equation the measuring member, $MJ^{½}H^{½}L^{2}T^{-2}$. That completely and rigorously unifies physical science.

§83. a. It finally remains, to complete our chapter on the explicit formal unification, to make a brief statement (in this section) of that complete theory or expression in familiar terms that will give us a more thorough grasp of the details noted; and then (in the next section) to indicate the possible extension of the general equation.

b. We have been seeing that physical equations, or in general any valid statements, were simply statements asserting some variously named splitting of the universe into parts, which splitting was a "property" (i. e., an equation asserts, describes, names a property). Now, the usual name for the product of that splitting is "*things*"; I also use '*thing*' as a name for the One. Some of the scientific technical names for things, beginning with "large" things, are:- *Energy*, universe, One, galaxies (I designate the galaxy or particular structure of stars in which our solar system is situated, as 'ours'), star clusters, solar systems, stars, planets, moons, comets, meteors, earth, Jupiter, molar bodies (such as solids, liquids, gases), molecules, atoms, electrons or corpuscles, and finally "waves" or "vibrations" of different sorts. We therefore need to note explicitly whether or not the same method of expression, of *naming*, that applies to (say) atoms in dynamic heat also consistently applies to galaxies. The observed fact is that it does—that a galaxy is identically the same sort of a structure that an atom is, differing only in the unessential numerical name of the L and T measure. The general truth of that is rigorously formally proved in the foregoing part of this chapter. In this section I state the formal proof somewhat explicitly. Parts Two and Three give the proof in concrete terms.

c. As we saw, Richards's effectual conclusion that the valid expression of phenomena is explicitly $p...\times v...$ is equivalent to asserting that we must say *That*$...\times$*This*..., *whatever* part *That* or *This* may be. Therefore, it follows that if the universe is split into (say) just two bodies—a *That* which we may name *sun* (or it could be a galaxy, an atom, etc.), and a *This* which we may name *earth* (or another galaxy, etc.),—then those "two" bodies can not be sharp and exact and constant; even just those two would be continually changing, and must still be written *That*...$\times$ *This*.... Or, to make that explicit and more conventional, suppose that there was-were just the sun and earth (with all other "bodies" wiped out, except that the sun and earth are not taken to be perfectly rigid or absolutely static—and truistically they can not be if the One is formally divided into that Many, the truism being the reverse statement of the first part of this paragraph). Then, orthodoxly, the earth and sun are taken as being in effect a perfect gas, and it is then assumed that the problem of their relative motions, *the problem of two bodies*, is rigorously exactly soluble (for solution, see "Ency. Brit.," ii, 803-4). But obviously no such solution is possible (see next paragraph). The problem of two *actual* bodies is not exactly soluble, any more than is the problem of three bodies. Hence, in brief, there is no exact science; we can not *explicitly* say or use pv about *any* two actual bodies; always the explicit expression is $p...\times v...$, with the dots indicating an infinite regress which may be formally stated but never exactly evaluated. —— Newcomb shows in the place just cited why the problem of three bodies or more bodies is insoluble; it amounts to showing that there is an infinite regress. A mathematical "solution" of the problem has recently been made by Sundman. Judging from the descriptions of the solution I have seen, he simply has a formal one, which explicitly involves infinite regresses or series which can never be exactly evaluated; and hence, athough it is a formal solution it is not an actual one.

d. The briefest proof that the problem of two bodies is not accurately soluble when actual bodies are considered is that because mass varies with velocity, then the average point center of gravity of the two bodies is never steady relative to the geometrical parts, and hence the problem is identical with the problem of an infinite number of bodies and truistically is quantitatively insoluble. —— That proof is of course identical with, and inclusive of, all the proofs of the same thing (clearly it is the infinite regress) given from various points of view. I shall indicate some of those proofs in the next paragraph. Here it may be noted that that general proof is identical with saying that every actual body in the universe is *asymmetrical* with the universe or with any other body (obviously, that is also immediately a truism from the theory of incommensurables, §50). —— And that general proof is merely a verbal way of expressing the equation $F...\times L...=MCL^{2}T^{-2}=Energy$. For obviously that equation asserts ever-varying M's, so that no two given M's would remain the same for *any finite length of time*; hence, no two could have a *verbally* fixed or *determinate* orbit.

e. Neither one of any two actual bodies is absolutely rigid (all of Part Two is implicit proof of that). Hence, unless the departure from rigidity is absolutely identical in each body (which is not the case, as is obvious by using universal circular reasoning and coucluding that there is no such symmetry; or, by so-called direct reasoning, there is only one chance in infinity of identical departure from absolute rigidity in each, and therefore not such a departure), then the bodies would have different amounts of tide, which would move the point center of gravity and make the orbits insoluble, in any numerical or verbal exactness. —— In the same way, any two actual bodies are electrified in some degree. Any relative motion of them changes the relative electrification (§134); hence, the orbits truistically vary infinitely. —— And *any* phenomenon between the two bodies will similarly give that same result of variable orbits. Hence, not even the "heavenly" bodies constitute a perfect gas, and there is no *absolutely* "free" space, or "empty" space (except of course those terms may be applied to the One if it suits the speaker's taste and agrees with his other phraseology). Whenever "free" is applied to *any part*—to any unit of the Many—it obviously truistically is a *quantitative* term implying some *degree* of freedom, and not absolute, as we see repeatedly in familiar terms in Two and Three.

f. A point of much interest is that in the orthodox pseudo-exact solution of the gravitational orbits of two bodies, the "velocity" of the travel of gravity-force is taken as infinite. The absolute solution of *why* gravity has that speed is simply:- gravity pull is asserted to exist before we ever begin to talk about it: consequently, if we say it is *there*, then inevitably, as a purely verbal truism, it *is* there; or, in conventional mathematical terms, in order to *be there*, it has an "infinite velocity." E. g., in our general dynamic molar equation $W...\times A...=MG^{½}L^{2}T^{-2}=Energy$, I have asserted that gravity does exist between all M's, and that is the same as saying that it travels at infinite speed. *But*, that assertion means precisely the same thing as was meant in §80k

when it was shown that the dynamic heat equation asserted infinite temperature. I. e., as was shown, it is not *completely explicit* to use just the dynamic molar or gravity equation alone. The complete truth is the combination of the molar static and molar dynamic thus:- *Extent of internal splitting into M's...*$\times$*This moving pair of M's directly considered...*$=MCG^{\frac{1}{2}}L^2T^{-2}$=*Energy*. *Then*, the *relative* velocities of naming the *M*'s (i. e., naming them internally *and* externally) are implicitly expressed by the equation $CG^{\frac{1}{2}}$=*The criterion velocity of naming*—which velocity is in general actually roughly V_1 for us, but not necessarily so. But the *separate* velocities (i. e., the "velocity" of naming the *W*..., and the "velocity" of naming the *A*...) can be *anything*; i. e., they are absolutely indeterminate, because to separate them is to speak of bodies being absolutely static or absolutely dynamic —which would be ineffable One talk. Consequently, when we customarily consider that gravity merely *is there*, or is formally G_e, its corresponding $_e$ velocity is ∞; and we then *relatively* consider that the time of our travel between the static body and the dynamic body is 0 (i. e., the two bodies have the queer standard or $_e$ name used above:- *This moving pair of M's* DIRECTLY *considered*). As soon as we observe that we are co-relating that 0 with ∞-speed gravity, the "reason" for that speed of gravity becomes obvious:- it is a mere truism of the formal naming of gravity—the verbal trick of the One and Many. Therefore, as a further truism and rigorous and absolute explanation, if we wish to be completely explicit about the law of gravity, then the valid equation must explicitly contain a '*second*' expression of inverse square, precisely as in §77 we saw was in a complete Ampere's law (cf. §§100, 128, 134). If thus completely explicit, we could with verbal consistency say that the velocity of gravity was the same as an electric current (roughly V_1 in ordinary circumstances), and work out all molar mechanics just as electricity is stated. *But*, then gravity phenomena obviously *become—are*—what we usually call *electric* phenomena. Consequently, as the summing up truism, we may say that gravity travels at *any* speed we wish to assign, *and on that speed* work out a complete, rigorous, unified science; but in every case where we say gravity has some speed other than the *almost* One or $_e$ "infinite" speed, we are using *gravity* as being a phenomenon other than the one we conventionally consider it; e. g., if we give it the speed of light we have what is usually called electricity, as before mentioned; and as "electricity" from a conventional view is sometimes light, then gravity would also be light. Or, in other words, as we saw in §73d, Newton's law assumes that gravity travels at an absolute infinite speed. But that is the mathematical limit, and does not apply to *any* actual body. Such gravity just verbally *is*, exists as a logically pure relationship, or is God the Holy Ghost. Obviously, *no* mechanics of such gravity is possible—for such an infinite gravity is not scientific but religious in form. We see details of that point of view of Newton's law from time to time. —— And in general therefore, *we can have an "infinite number" of sorts of "phenomena," the difference between any two sorts being that the 'speed of naming' is different*; and nothing else but such a quantitative distinction does differentiate phenomena. But as we have already seen in the case where "gravity" became "light," all those different phenomena are really identical—that being a truism of course, because "speed" is merely LT^{-1} or the ultimate identical relationship. —— Therefore, in this paragraph we directly see the complete solution of "Why does gravity (or any phenomenon) have a certain speed; and what is that speed?"; but we also see the truistic result that in a unified science all phenomena become identical except as we *arbitrarily* distinguish them. And the *only* arbitrary way of differentiating is to assign each sort a particular speed or LT^{-1}.

g. We may now look at the general meaning of introducing the inverse square law a second time. It involves some repetition; but this subject of *harmonic periodicity* is the summed principles of final quantitative expression of knowledge, and is of sufficient complexity to make some repetition perhaps acceptable. When in usual language we name a standard or a whole One, we imply the possibility of splitting it verbally—which implication is the infinite regress. And in nearly every sort of statement, we use a standard molar body M_e, that to begin with is logically a One. That M_e is formally absolutely static—is internally not split. Then, as an *if*-agreement in language, we change that M_e into *MC*, and write *Energy*$=MCL^2T^{-2}$: but that is merely the verbal form of agreeing on preliminary naming of what is *going to be actual* energy (§§73, 77). Then in any case of actual transfer or exhibition of energy, some or all of one such molar body must pass from itself to another such molar body and be incorporated in that second one. And truistically, that can not occur if the second (also the first, in point of fact: cf. the nature of the infinite regress of *C*... at the end of this paragraph) is actually internally static as just asserted. Hence, the second must, as what we might call an MC_e (note the $_e$), be itself split into parts, or be made 'dynamic,' by the second use of that naming law—and we get the expression $MCG^{\frac{1}{2}}$. We have seen all that before: now we come to a little clearer way of expressing it:- Obviously, in *every* case when actual energy is exhibited, we must formally pass (or concretely:- have matter pass) from a body made up of parts (say molecules), to a molar or formal $_e$-body —and we may generally consider that as passing from one sort of arbitrary physical structure (i. e., one split in a certain way) to another structure of a *different order*. (Those *orders* may be conceived thus:- electrons combine into a "higher" order, atoms; atoms into "higher" molecules; molecules into molar bodies, or into biologic cells; cells into persons; molar bodies into solar systems, which are atoms or cells of a galaxy, etc.—as we shall see in detail.) Every time we make such a "step" (either "up" or "down") we need to introduce into the *measuring member* a new coefficient implying one additional use of the inverse square law (orthodox science does not clearly recognize that need; also there are no such *essential* "steps" anyway, they being merely arbitrary quantitative conveniences which merge continuously into each other, as was proved generally in the last paragraph, and will be shown in intelligible detail throughout Two). Every time we take such a step to a different order in the *naming member* we ought to *name* a new *This* and *That* (and orthodox science usually does that). Then, as there is no logical limit to the number of different orders of structures (as just seen, they ultimately merge together continuously; or as a concrete example, stellar galaxies exist inside atoms, differing from our galaxy only in unessential size, §105), we may *explicitly have the numerical coefficients in infinite regress*, each order or *period* being obviously related to all the others (hence the name '*harmonic* periodicity') and all therefore necessarily being formally based on whatever arbitrary unit measure we start with (which, agreeing with the structure of our nervous systems, happens to be V_1). I. e., if we wish to write '*(varying with)*' *explicitly* and also in agreement with our previous symbolic way of doing it, we have *C*... (in *MC*...), and not just *C*. And that $MC...L^2T^{-2}$ is *the measuring member in complete symbolic explicitness*; but as we saw in §76d, we can't practically be so infinitely explicit, so we chop off the logic by indicating its nature by different names that use the inverse square in a "step" of an

appreciable size. The universe runs in such "rhythmic" appreciable steps for reasons we shall see. The periodic table of "chemical elements" is an example of perceptible rhythmic steps that are some of the dots in (say) *C...*—the total change not being considered quantitatively enough to add an inverse square naming (it may be in the future).

§84. a. Thus it is obvious that there is possible an unlimited extension of the various *measuring* expressions of science. I have above reduced those expressions to their simplest forms, and omitted substantially all manipulation of them—omitted "mathematics." That extension of science is here called harmonic periodicity—a poor name. That is in distinction from the use of the *naming* or *That...×This...* member, which use is called "mechanics," "mechanical theories," or "scientific theories," but which technically is philosophy (§39d); and when the names in that member are familiar its use is called "common knowledge," or "information." 'Harmonic periodicity' is not definitely recognized as being an existing general aspect of science: it is a sort of general name that includes all of what is tacitly included in "measuring" and "measurement." Its definite expansion requires primarily a rewriting of calculus in a way that agrees with the basic logical rule, and then an application of such mathematics; most of the volumes needed for that is omitted from this book.

b. Recently there has been a vast amount of measuring or "experimenting" in science, and an inadequate proportion of consistent expression of results. In so far as this book consists of "science," its chief purpose from such a technical point of view is to supply a consistent basis for such necessary expression of results already obtained. This chapter, from that technical point of view, is mostly concerned with the principles of the measuring member—science technically *is* chiefly that member (39f). For centuries men will have to try various applications of those principles before there will be excellent judgment as to which forms are most useful in our practical, verbally split universe. I have shown that I have given nothing essentially new in this chapter: the work of Richards was shown to be a generally accepted basis of those principles, his facts about $p...\times v...$ being directly translatable into the chemical measuring member, of which Van der Waals recognizes the need ("Ency. Brit.," vi, 846).

c. I shall mention other excellent work that may furnish useful hints for the explicit extension of science (see Index, under the men's names, for further details):- Reeve's "Energy" is highly suggestive. It is not explicit in the unification of all science, nor in using the measuring member. But it takes a point of view of treating $p...\times v...$ which has its special advantages (§92). And Reynolds, in "Sub-Mechanics of the Universe," and in the popular "On an Inversion of Ideas as to the Structure of the Universe," gives some curious mathematics that are applicable. Marshall, in "Principles of Economics," is continually treating the variation of our naming factors. He uses conventional mathematical forms for summarizing his work with such variables and those mathematics will furnish some guidance for expanding our measuring member. Marshall almost explicitly uses valid logic in that work; practically he always does, so far as I have observed in reading the first half. Erwin in "The Universe and the Atom" is particularly good in pointing out the regress of the different orders of structures (§§83, 94). He orthodoxly uses classical logic, introducing 0 and ∞ without regard for our rule; but he uses good commonsense in keeping them practically balanced. Patten has unified the biologic history of man by his "Evolution of the Vertebrates and their Kin," and has since been using a valid and strongly dynamic logic in extension of the unification to some of the most difficult forms of *That...×This...* in "The Grand Strategy of Evolution." Ritter has used the naming member excellently in several biological books, unifying general biology in a way that would be a useful guide to physicists. And Jordan has done that in numerous books in all the biologic sciences. Eugene Miller in "The Secret of the Universe" gives what is actually a good *monistic* account of gravity, and by implication of any sort of $MG_e^{\frac{1}{2}}$, etc.—not of the actual $MG^{\frac{1}{2}}...$, etc. Possibly Miller does not recognize it for just that; but a reading of his book will help the intelligent physicist to learn to distinguish between pure formality (which of course is religion in our strict sense of §39, as are all 'pure' or perfect things, even "pure science"), and Many science. Finally, Bjerknes in "Fields of Force" keeps pretty logical even when using vector analysis—a species of mathematics worse than that in §44 or than Einstein's in §66. I have profited much from those men, and have used their ideas.

d. We are now ready to take up in Part Two the usual sort of description, or mechanical theories, of the universe, as given by the naming member, *That...×This...*. That sort of description, because *That...×This...* is truistic with $M(varying\ with)L^2T^{-2}$, will obviously serve to repeat, in more intelligible form, the argument of this chapter, and the general investigation of this Part One.

PART TWO

CONCRETE UNIFICATION; or PHYSICAL SCIENCE

CHAPTER X. *General principles, and general mechanical theories, of science.*

§85. a. The everyday way of naming things is briefly symbolized by the naming member *That...×This...*, or by some of the variations of it, a number of which we have seen. The use of that form of expression gives what is commonly called *description.* I. e., we *name* things in a related series until the hearer gets a name which he knows, from his previous observation or experience. The remainder of the names then become intelligible to him (fundamentally, because he is at least intuitively or vaguely aware that all relationship is identity, §28h: hence, he merely identifies, finally, the name that he knows with the other names that were related to it). The *description* is therefore obviously also a real explanation (Index, "Explanation").

b. Hence, if we are to describe the universe we keep on naming *This*'s and *That*'s until the hearer grasps the identity of relationship of everything he ever saw or rationally imagined. (For the implications of the psychological half of that assertion see the chapter on psychology, XVII.) So as a truism the only valid description of the universe is also a unification. Such a unification—specifically, the actual grasp or comprehension of the whole (Index, "Rebirth")—is as a sum what is usually called religion. And for centuries men have tacitly accepted these general statements I am making here in a form which already is obviously true, or

will be made so in due time. That men did accept these statements is historically shown by the fact that every religion that received much acceptance undertook to give just such a description (which is now usually considered "scientific") as its base. Hence, as we are in this Part going to have such an everyday description of the "material" universe it is well to recognize and keep in mind that final religious aspect of the description—an aspect that shows the importance of the description.

c. The somewhat expanded descriptions of the universe are, as such, nowadays termed science, it being tacitly assumed that valid, consistent descriptions are meant. The chief reason for formally detaching those descriptions from "religion" and giving them a new name "*science*" was that the "religious" authorities became egotistical with their power ('power-mad,' like the former Kaiser; §173) and tried to use the descriptions to exploit others (§49b). I. e., such aristocratic authorities substantially claimed (1) that they were better able to find out the consistent descriptions than ordinary people, and hence because they were thus "superior" to laymen their dogmatic descriptions for that "reason" must be accepted.[85c] Because their descriptions were always liable to be somewhat inconsistent, the "religious" authorities, in order to hide their errors (they hide them from even themselves in the end, becoming dupes of themselves; §155), naturally lost sight of the possibility of *application* or *use* of the descriptions, and claimed (2) that there was some sort of magic perfection about the descriptions; e. g., some people still claim that there is some sort of magic or supernatural verbal infallibility about the Bible. That infallibility of course tacitly is taken to shed its privileged aristocratic glamor over the persons who assert its existence and can manage to get such a claim accepted; for they too thus become more or less perfect Gods or mouthpieces of such, and thus presumably superior to the layman who does not "know" so much and honestly takes on himself the responsibility of proving the truth of what he says, even when he quotes an assertion from the Bible. —— As a direct consequence of such ecclesiastic mental evasion those "religious" descriptions became an end in themselves:- the "letter," the mere phraseology, made the Bible a golden calf, and finally served as a mental dope that drugged the dupe's mind so that he became unseeing to much of actuality. Therefore, descriptions of the universe tended continually to stop being useful. For, as soon as the layman began to try to apply those descriptions to his own seeing and further living, he actually was making a first-hand investigation of them, and he then readily found some of the mistakes of the authorities—that the pope or other sort of religious autocrat was not actually infallible, and that even the honest original prophets made mistakes. —— The argument also applies, with merely verbal changes, to *any* "authority": ecclesiastics and their power-mad brothers, the demagogs, are merely the most marked types. Often there are "scientists" who undertake to be popes in science; but the percentage of such men in science is small: I have encountered only two or three who have much reputuation and were so weak as to let it "swell" their heads. —— Consequently, the "spiritual" aristocrats substantially denied that those descriptions were useful in the sense of being applicable to this "wicked" world. They practically were forced into that denial in order to protect their own aristocratic power, privileges, etc., in that same "wicked" world—although of course they were not so brutally clear about the reasons for that denial, or even about the denial, as I have just been.

d. Incidentally, it is obvious that to "apply" our descriptions means finally to use them to foretell or prophesy the future. The full meaning of that is implied in the chapter on ethics; but it is sufficient to consider here its rough, everyday meaning. When we "describe," we use the relationship of identity, and as a truism can go on and by observing the relationship state things not yet *directly* observed —i. e., describe the "future." That is clearly in agreement with the fact that *L and T* are not real: of course, if *T* were absolutely real it would not be possible to predict the future (see §150d for rigorous proof of that). And it also obviously is a truism, that because whenever we use *L* and *T* we are inaccurate, we can not ever predict the future with accuracy (the *degree* of accuracy we can achieve is a quantitative matter that is a part of the theory of measuring or harmonic periodicity). But we can not tell with accuracy what happened yesterday—e. g., witnesses and history are notoriously unreliable in accuracy. Formerly it was tacitly recognized by theologians that such prophesying application was finally required of any truth, and there were such predictors, or "prophets." But nowadays, the dogmatic theologians, consistently with what has been said about their professional exploiting and evading tendencies, substantially refuse to accept the possibility of prediction—to accept the possibility of there being any more bonafide "prophets." They thus obviously completely stultify themselves. But they do claim to predict a future world—concerning which they erroneously fancy there is no direct experimental evidence to check them up and confute them. We shall see that there too they have been wrong (§§144, 152).

e. Hence, it was rather convenient to give the new name "*science*" to those same continuing-attempts at descriptions of the universe, so that under that new and unsullied name, which at first had no trademark value to the aristocrats, these two essential things could be emphatically required of the descriptions:- (1) that those who expressed such descriptions should get them by repeatable observations, for the correctness of which they were explicitly personally responsible, and not get them by rather irresponsible tradition, rumor, and hearsay; and hence would give descriptions which the hearer was able to verify by observations—tests—of his own; (2) that the descriptions would hence always be applicable and therefore useful. —— The name *science* is now rather old, and has acquired considerable trademark value for exploiters: so some weak "scientists" tend to ignore the fact that all valid science or description must, as its actual test, be applicable and useful—i. e., simply must be relatable to *any*thing, regardless of the arbitrary *L* and *T*. And in the same way, unbalanced or aristocratic persons in other professions tend to exaggerate "classics" (not having strength of their own to produce work that will stand inspection), conveniently forgetting, in order to save their own egos (which then being without restraint often swell enormously), that if anything is true—i. e., universally self-consistent or related—it is, merely as a verbal truism, always applicable and useful. A thing which has no *perceptible* application, use, or *immediate* human worth (*to the perceiver*) by common consent as to the meaning of words is ugly, evil,

[85c]Those "religious" authorities usually do formally claim that their descriptions are those which are "divinely revealed" to various men other than themselves (and they generally select men safely dead, who can't question the accuracy of the authorities' quotation). But as the authorities *themselves* judge *who* is thus inspired, those "revealed" descriptions are in reality asserted by the authorities *on their own responsibility*, and I shall not belittle the intelligence of the general reader of this book by discussing in detail that childishly transparent evasion of the theologians. When *I* pick out some former good observer and say that a doctrine of his is right, I assume the responsibility of proving that doctrine—a responsibility that any fairly reliable and intelligent modern man always assumes in such circumstances.

worthless (XVIII). And *all* things, whether "classic" or not, are ultimately, in a One sense, truistically beautiful, good, and applicable (§25b).

f. This section therefore sums up:- (1) That a valid description of the universe is really religion when comprehended *as a whole*. (2) That such a description is now commonly called *science*. (3) That the advantage of the name *science* over "*religion*" in the perverted ecclesiastical sense is that it serves to emphasize that, as a verbal truism, such a description is (i) verifiable by anyone who wishes to make the responsible effort of observing for himself; (ii) useful, applicable, beautiful, good, etc. —— Therefore, as the summed conclusion of that general survey of science, I shall try to give to this Part Two, which is explicitly such descriptions, those chief characteristics of verifiability and applicability. Part Three, humanics, is the further direct extension of this Part to humans and must have the same charactistics.

§86. a. As the purpose is to describe the universe with direct verifiability, it next becomes necessary to determine how to do it—the method;—to answer the question, What is the best way? (If the description is universally verifiable it truistically equally is applicable.) The general answer to that question is obviously given by, or is, Part One. The specific answer is that we need to use the most familiar form of everyday speech or naming, and that that is the use of the form which we write generally, *That*...×*This*.... We therefore shall observe in the remainder of this chapter the general ways in which that formula is customarily named and used. After that I shall proceed to use it in such ways.

b. Possibly the most general naming of the *meaning* of that formula is to say that it expresses *continuity*. Conventionally, continuity is said to be the basis of science. The word obviously means 'identical relationship,' and hence is in complete accord with the truisms that formula expresses (IV), and especially with the general characteristics of our description as stated in the last section.

c. In modern days continuity is usually said to be exhibited and expressed by, or as, a "sequence of events." I. e., phenomena are held to be in a continuous, unbreakable "chain" or series. The old name for the same thing is "cause and effect"—for any observed phenomenon or "effect" there is always a preceding unique and completely efficient "cause," or thing which produced or made the effect. The phrase "cause and effect" has become somewhat unfashionable, substantially for two reasons:- (1) to say that a cause *produced* or *made* an effect is formally equivalent, in the parlance of classic logic, to an assertion that the cause is an absolute creator, and hence to imply a dualism that as a finite pluralism definitely goes back to, and implies, a "First Cause"; (2) and to assert a cause as a sufficient and unique producer is, by classic logic, formally to imply that the universe is sharply cut up into absolutely separate parts—and it is also, in a way, getting 'relationship' mixed with 'thing' or Many; i. e., the word *cause* in this second aspect is likely to mean a combination of a thing and a relationship. Clearly, both conventional objections to "cause and effect" are correct (IV-VIII); the very existence of those objections obviously indicates that in practice science substantially repudiates the classic logic. But if we write for our formula, *Cause*...×*Effect*...=*Meaning*, then to interpret the two factors just as we interpret *That*... and *This*... clearly obviates the two conventoinal objections to the phrase (and also uses valid logic, and not classical). And it is at once obvious that science in making those objections to "cause and effect" substantially asserted precisely the same argument as ours in formulating *That*...×*This*.... So it is apparent that we are in agreement with the base of orthodox science.

d. Because all such words as *This* and *That*—i. e., all Many names—are actually subject to precisely the same objections as are "cause" and "effect," if strictly interpreted by classic logic as being without dots or infinite regresses (even implied ones), it would be *practically* inconsistent to bar just those two names (*Cause*... and *Effect*...) and make them unfashionable. Hence, I shall use the two, in the meaning indicated in the formula given. Any cause therefore implies an actual infinite regress of contributing or related causes, which *finally* sum together as a closed universe, or as a "circle" (in which all of the causes are really identical with the effects), and which summing precludes any such nonsense as the classic logic "First Cause." And any effect similarly implies an infinite regress of effects, all of those too being finally related as identities with the causes in a closed universe or "circle," which hence precludes any such nonsense as the classic logic "End," or "final end," or "Final Purpose," or "Purpose." The reader who is familiar with philosophical slang will note that *teleological* systems thus simply vanish—nor are we to get in lieu thereof any of the often objected-to "chance collections" or "fortuitous concourse" of atoms as being the universe (it has already been pointed out that the universe is an organism; see §144, and Index, s. v. "Teleology," "Personality," "Organism" for additional proof). Further, as a part of the same truism, to use everyday theological terms, there is no such thing as Final Judgment, or Judgment Day. There glaringly can no more be any such sharp, definite, separate coming of a "judgment of the quick and the dead," than there can be an absolute splitting of the universe into unrelated parts. The universe *as a whole* keeps, so to speak, a set of ledgers (cf. §158c) which are always instantaneously balanced in full to date. We see those thing more definitely later: I anticipate them here merely to show that there are no separate "watertight compartments" in which we can keep "science" and "religion" apart—to show that religion and science do *not* "deal with entirely different spheres of reality" as the Catholics claim (§48b). Just a slight clear and honest consideration of words people use almost daily, *cause* and *effect*, instantly exposes the error of such theology.

e. So science, and commonsense people, have obviously used the valid formula *Cause*...×*Effect*.... In that use we have made the extremely commonplace observation that one phenomenon or part of the universe acts to produce another or cause another. And that effect then obviously reacts on the cause, or 'stops' all or a due amount of it. (It is obviously precisely the same as saying that energy is the transfer of part or all of one body to another; §83g, etc.) So, as an equivalent statement, we may translate *Cause*...×*Effect*... into *Action*...×*Reaction*.... (Perhaps the usual point of view would make *Reaction*... the extensive factor, so that the formula would be *Reaction*...×*Action*....) That formula is so obviously the same observation, and the same general way of naming things intelligibly that we usually take it for granted without explicit expression. *Action*...×*Reaction*... is verbally equivalent to *F*...×*L*... of the last chapter. And *Action*...×*Reaction*... is the naming form of expression that is named "mechanical theory."

f. We have seen (§§15, 21) that a machine essentially consists of at least one unit of the Many acting with at least one more such unit in really inseparable connection—i. e., in ultimately identical relationship. And another word we use for machine is *structure*. A structure consisting of usually numerous perceptible parts, thus verbally inseparable, is an *organism* or a *person* (and in our practical language, the parts or splittings are based on V_1; see XVI, XVII). We now see from the last paragraph that the general form of everyday

description of things consists essentially of verbally putting them together as such "machines" and having them "work" —observing them work, or transfer energy, or die or be born with more or less completeness. If the things *verbally asserted* to be consistent—to go together—fail to "work" or react or act in a perceptible way, then obviously there is no perceptible consistency or intelligibility or explanation. When there is perceptible reaction, then as a truism the "mechanical theory" is correct expression of verifiable description. And further, when we start using such mechanical theory, names are given to actual parts of the Many, and as such expression, are directly verifiable. Hence, it is a truism that "mechanical theory" is merely a solution of the One and Many, in which solution we emphasize the names of the parts or the arbitrary Many, as a means of providing for continuous verification and positive intelligibility—two actually identical things. We positively grasp the One by such a method or trick. Of course, if we mistake the *method* or "letter" for the reality (fall into verbal idolatry), we have *materialism* if we use Many words, and *mysticism* or totally unintelligible talk or dogma if we go to the opposite by using One words (§§20d, 49h, etc.). So I shall avoid such verbal idolatry—shall state and prove mechanical theory, apply it to different machines, and then use those machines or organisms or persons as models of the universe.

g. We have already seen in Part One that an "infinite number" of valid languages may be formulated; it truistically follows that a corresponding number of valid mechanical theories can be formulated. In fact, we saw that each language was a machine (VIII), and this present formal repetition of the same idea need not be expanded. It also follows that an indefinite number of machines can be validly used as models, each of which represents all the various *That*'s and *This*'s. In fact, we saw that the single surface ring was (especially when in motion) a machine model which would give an indefinite number of forms—and all of that furnishes rigorous proof that any one of an indefinite number of mechanical models will validly represent the universe.

h. And that is the total of the principles of all knowledge or science. It implicitly includes the measuring member also (§84b). Those principles are extremely simple, obvious and familiar; probably most people will agree that any fairly intelligent person can understand this chapter so far—and we have already seen the essentials.

---

§87. a. The brief statement of mechanical theory is correctly given in a general way *in terms of our ordinary Trinity language* by Newton's three laws of motion, which I usually call 'Newton's laws,' or 'laws of motion.' By examining them briefly below, I shall show that they are rather vague; are negatively expressed; and omit too much that perhaps ought to be expressed explicitly. But they are substantially valid; and are in effect a correct solution of the One and Many, which we just saw is essential in any valid mechanical theory.

b. Nowadays numbers of non-Euclidian mechanics are being promulgated (e. g., the Einstein relativity theory, §66, has come into prominence since this was first written), and their announcers seem to assert that the Newtonian mechanics are wrong. Newton's mechanics do have grave defects, as we shall see. But they are shown to be probably quite good enough to justify the high esteem in which Newton is usually held. His law of gravity was a mere incident to the formulation and use of those three laws, and he got that law rather thoroughly irrational. I think myself that Newton knew there was no "sense" in his law of gravity. But all those objectors to the essential soundness of the Newtonian mechanics *could* formulate different and valid mechanics in any of the indefinite number of languages using non-Euclidian space, or using *n*-dimension space. The method is indicated in VIII. But it would be a tedious job, and the result would have to be translated back into our language; so I omit such mechanics from this book, except for the outline in §66 of Einstein's, which shows that it is merely another form of the solution of the One and Many. —— The reader may need to know, the better to understand later discussion, that in my opinion Newton was a thinker of the first order. He enjoyed the advantage of having four or five contemporaries about as good—and I think that in all-'round greatness Halley was much superior to Newton. About a century later Ampere was about as good as Newton—Ampere had greater opportunities, and possibly did not use them quite so well as Newton used his. He had six or seven contemporaries about as good as himself, followed a bit belatedly by Faraday, who seems to me to be a little better than Newton. Then, bringing us to our times, Darwin and Buckle were the first of eight or ten thinkers who I think are somewhat better than Newton—took better advantage of their opportunities. Dewey, Jordan, and Reynolds undoubtedly to me have a wider, surer grasp on things than Newton did, which grasp they mostly had to work out for themselves. —— But always there are backward-looking people who hold that the Golden Age was in the past, and that all the best men are dead. Roughly, there are two general facts about the mentality or intelligence of such people:- (1) they are not intelligent enough to recognize a first class man when they see him (and in general all success consists in picking a winner, whether a thing, an idea, or an individual—the individual being hardest to recognize, as shown in Three); so those backward-lookers can't recognize the size of their contemporaries, but because of such poor vision have to wait two or three generations until a general chorus of opinion has time to start, and then automatically join in without knowing particularly what they are talking about; (2) they are so blind to things in general and hence especially to their own limitations that they have a deep-seated conviction that they, having imbibed [at least the superficialities of] the knowledge given by the great thinkers of the past, have reached the limit to which human knowledge can go; hence they automatically deny that any of their contemporaries can go further and exhibit first class ability. Well; personally I would rather deal with those safety-first, backward-looking people than with the even weaker minded lion-hunter who thinks he has found a Messiah in every unbalanced and often unwashed eccentric or radical he sees. So picking a winner has dangers on either hand; and many people in effect openly acknowledge that they are failures in some ways by stating that they will let the "future" give a "verdict."

§88. a. Newton's first law is this (for the three laws I use Daniell's "Physics," 5-6):- "Every body tends to persevere in its state of Rest or of Uniform Motion in a Straight Line unless in so far as it is acted on by impressed Force." That is conventionally tersely expressed:- matter has inertia. It asserts that if there is an absolutely separate universe or One (a body or One absolutely distinct from any other), *nothing* can be imagined which would affect it. Only when there are tacitly other bodies *related* to it (so that the relationship "force" can explicitly exist) is there any *change* in state. So it is obvious that the terse assertion of inertia is simply a *negative* statement of the existence of the One. Newton's actual expression asserts or names a One, and *implies* a *possibility* of its later being divided; and hence the total assertion is that matter (or that the One) has inertia. That is a 'negative universal property' of matter; if we say

that a perfectly black closed room is not light, then 'light' is obviously a "property" of the contents of the room in precisely the same way that "inertia" is a "property" of matter (there are verbal contradictions in such statements, of course; a real One—a body really "in a state of Rest"—is ineffable, and to say that it has a "property" is logically to split it into a Many, so that it is no longer such a One). Newton expressed this law otherwise by saying that action at a distance—across an absolute separation—is inconceivable.

b. Clearly, his first law is substantially equivalent to what we started with in formulating language:- the verbal naming of a One which we may arbitrarily divide. So it is merely a preliminary statement of agreement as to language mechanics, equivalent to the 'existence assumption' in §22. It is equivalent in detail to:- '*all* matter (the One), as such, has the "property" of *not* changing.' And that is no "property" at all, but an assertion that '*all* matter' is *not-divided* —which is a verbal truism at the beginning of monotheistic speech. Therefore, the first law is "proved" simply in that it is a truism. In the classic logic sense the first law is not provable—a fact which is recognized by leading physicists, who thus again agree that classical logic is invalid.

c. That negative One form of Newton's obviously implies the reverse, or the *positive* Many form:- mass varies with velocity. —— And of course, that '*mass*' implies a *portion* of the universe; for only a *portion* can have a positive or statable velocity. Motion in a "straight line" for a finite distance is not positively statable; i. e., it is infinitely improbable, or contradicts the theory of commensurability (§50) or the infinite regress (IV), and no actual body in the universe moves so—as we shall see in more detail from time to time. And "rest" is zero motion. So it is also obvious that Newton, in postulating the One, rather explicitly showed that both 0 and ∞ expressed it—because we might consistently call motion in a straight line 'infinite motion.' For we have seen in the problem of two bodies (§83) that any actual body is always changing direction *relative* to any other body. So only the universe, an absolute One, *could* move in a straight line. Then the name "infinity" applies to such unrelatable motion—meaning simply that any name is equally applicable and mystic. Any *really tangential motion* of a body (i. e., motion which *formally* is *not* affected by a second given body and truistically deviated from that straight tangent) obviously logically holds the first body to be a One; hence that motion or its energy is absolutely indeterminate and mystic —and really can not occur, except to the total universe.

d. Because, as was seen, there are an indefinite number of valid forms of negative expression—of statements of what a thing is *not*,—and only one general valid statement in a given sort of language of what it *is*, Newton naturally followed the easiest course of making his first law negative in form. And as a further result, orthodox science consists very largely of negative statements—expressions of what is not so, rather than of definite statements of what is so. When it says that inertia is a fundamental "property" of matter, then all M's are logically multiplied by zero or "no" to begin with. Hence, the only change needed in the first law is to formulate it positively instead of negatively—which we have done in the general discussion of how to split the One and get *That*...×*This*.... This book in general makes science direct instead of negative: positive instead of agnostic.

e. Newton's second law is:- "Change of Motion [*Motion* here, as used by Newton, is equal to $M(LT^{-1})$, which is now called momentum] is proportional to the impressed Force, and takes place in the direction of the Straight Line in which the force acts." Hence, *change* of Motion would be the variation of $M(LT^{-1})$ during a T; therefore, the law says:- $F=MLT^{-2}$. Obviously, Newton condenses too much there, and gets a confused result. By saying that a change takes place in a straight line, he rather inclines to the implication that his MLT^{-2} is an absolute universe, and in agreement with that to say that his F is a standard unit F_e which moreover is itself a sort of standard universe or One instead of being even there an *irrational factor*; whereas, his F actually is F_r (see IX).

f. Hence, it is rather apparent that Newton in this law in a too brief way tried to assert:- *there truistically exists a relationship between the parts into which the One could be arbitrarily split*—that making the split-up-One (i. e., the Many) still the One. He rather clearly implied *That*...×*This*..., in which formula × is the relationship, *force*. So this second law is also purely verbal agreements of truisms—as is conventionally recognized by the assertions that the law is not verifiable by "physical experiments" (i. e., the law, like the first law, is merely "expression," and hence is subject only to formal or logical proof; §35). This second law, in its orthodox or Newtonian form *is* rather a confused jumble of assertion of (1) the One and (2) relationship—is amateurish logic or philosophy.

g. It may be reasonably held that his first law is an assertion of or agreement to use God the Father or One words. The second law then is a statement of God the Holy Ghost, or "force." And we shall see that the third is explicit statement of God the Sons. Although the first two laws are logically confused and omit most of explicitness, perhaps the only *practical* defect of much importance at first was that the first one was negative in form. However, I think the reader will readily see that Newton made a remarkably good solution and expression of the One and Many—and especially so, compared with the great confusion of views prevalent in his time ("Ency. Brit.," Art. "Motion, Laws of"). But what was fine in Newton is amateurish for us now.

h. His third law is:- "To every Action there is always an equal and contrary Reaction; or the Mutual Actions of any two bodies are always equal and oppositely directed." That is obviously a definite scientific or Many statement, because arbitrary portions of matter are considered as joined in a sequence of phenomena. It is directly equivalent to *Action*...×*Reaction*... (§86e), and as such is "mechanical." —— It may be held by some that Newton did not imply the dots, but meant a sharp dualistic statement of absolutely separate factors:- *Action*×*Reaction*. Well; it is a historical problem of some antiquarian interest; if Newton did not mean to imply the dots, then he was wrong—and we should not imitate such mistakes even if he did make them. But we have seen in the last chapter, and see further and in considerable detail in this one, that conventional science now is almost explicit in asserting the dots.

i. This third law, being explicitly pluralistic and explicitly stating that there are at least two mutually acting bodies or M's, *is hence a general description of God the Sons*. It seems to me that the first two laws, by establishing the verbal agreements as to expressing the One and Many, now definitely combine with the third law and clearly imply the inseparability of the "three" laws, and also clearly imply the dots in *Action*...×*Reaction*...—imply the infinite regress. At any rate, the reader can see that Newton's laws, if they have any consistent meaning, are the solution of the One and Many in terms that are conventionally "mechanical."

j. The third law, being expressed directly in terms of the Many, is "experimentally" verifiable—meaning "concretely" provable (§35). Of course, the *complete* verification considers the other two parts of the Trinity just as "real" as the Many is "real." We saw that such was true, when we

saw in §49j-l that our everyday valid logic considers each part of the Trinity equally real or verifiable; so we need not go into that again (but cf. §§150-1). We may simply note here that the reason for speaking of the Many as being experimentally, or concretely, or actually verifiable or provable is that we tacitly take it for granted without statement of it that the relationship of continuity or ultimate identity is *always* existing as "truth," and that the consequent summation of that Many all the time into a real One is also truth. In short, we take all of real religion for granted (we take for granted God the Father and God the Holy Ghost) *as being already proved*, and then have left only the arbitrary Many, and need to be shown *its* consistency *directly* as being proof. Obviously, as *proof in fact* or *in deed*—as ultimately concluding proof,—we do need such Many, or concrete, proof; but as *expression* of proof, we need the completion of the whole Trinity—and I simply give it, and do use as a part of that the Many precisely as is required in everyday life, or by "science." —— Obviously, the "proving" of anything by using an absolutely disconnected, dualistic Many, and ignoring that real religion (of which our valid logic is the expression) is wrong; is materialism; and given time enough will inevitably wind up in an exploiting aristocracy, autocracy, ecclesiasticism, and socialism (which are the names given to the chief "practices" of such ignorance), with corresponding stupidity, idolatry, and weaknesses in the exploited. (I am aware that ecclesiastics—and demagogs—violently contend that they are "spiritual"; they are something like the late Kaiser with his Gott; see §155 for the reasons for such contentions that flatly oppose fact.) But because the Many has thus been misused by being vastly overrated by those grafters (and their dupes), that is all the more reason why we should use the Many, and use it properly, in its due place and with its due value. Consequently, although I explicitly and definitely use Many or concrete proof in this Part, it is properly supplemented by the statement of logic in Part One—by explicit expression of the religion the average commonsense man tacitly takes for granted as the basis of "proof."

k. This third or Many law may be easily verified. I once saw a two year old child discover and state the law by his own observation. His statement was substantially this:- "When I push on something it pushes me right back." The two *M*'s were "I" and "something," and obviously *L* and *T* were inseparably included explicitly. Clearly, there was a push "out" from "I"; and science usually calls that point of view or 'direction' or 'form' of considering the relationship:- "force." But equally, there was a push "in" towards "I" in the "opposite direction"; and science usually calls that form of naming the relationship:- "pressure." But when the relationship itself is rather emphatically in mind rather than the arbitrary circumstances or direction of its naming, science usually combines the names "force" and "pressure" and calls the relationship "*cohesion*," which obviously means the same as the ethical name "*love*." And because there is in the universe as a One no absolute *direction* (for, as verbal truisms, there is not another One outside, with which to compare or relate and thus "fix" any direction; §§58g, 99), there is obviously no real difference in any of those relationship terms—which in general is equivalent to saying that all relationship is that of identity.

l. It is also obvious that because the "push" and the "push back" are equal, then the sum total of the "force," and hence of the energy, in the universe is zero. That obviously gives an absolute Nirvana, in which as a whole there is no energy. But we could validly take another view, and say that the push and the push back was each a certain amount of force, giving energy, and that as there was ultimately no real "direction" anyway, we would add them all arithmetically *as a formal way of speaking* (it has to be kept in mind that there is no real separation, or else that manner of speaking will run into an erroneous pantheism). In that point of view, the sum total of the energy of the universe is infinity. And that is the view we usually take. It merely amounts to reversing forms: zero is logically identical with infinity. The total energy of the universe is merely absolutely indeterminate or ineffable—there truistically being no other universe to serve as a standard of positive measurement. Hence, *any* force or energy or part is again directly seen to be unexpressible or unfixable from an *absolute* point of view. We merely arbitrarily assign to a part a certain intensity or potential—and that fixes, logically but still unexpressibly in exact terms (§50), the measures of all other parts *as parts*. There can be no absolute center or standard—no exact science.

m. So it is obvious again, from the child's discovery of Newton's third law, that an easily intelligible description of the universe is one in which we name those "*something*'s" and "*I*'s" in familiar ways, and state the relationship which exists—usually as what we prefer to name "force." And that is called a mechanical description—or mechanics. For any two bodies working together is called a machine. And Newton's laws state the trick of giving such a description.

n. So we are ready to look generally at the various conventional machines which have been used by science to describe or represent the universe. We note their characteristics, and select a machine we think is easiest to handle—to observe or see. Then we proceed to use it.

§89. a. There are several naming or mechanical descriptions of the universe in general use. The everyday description consists of various forms of the Trinity, as we have seen. That sort of commonsense, valid description actually ignores any real distinction between mind and matter, and speaks of things as being joined together as the "parts" of various "larger" things—making no real distinction between periods of time and 'periods' or extent of space (cf. §150). That is precisely what this book as a whole does. However I do it with explicit logical formality so as either obviously to include all conventional ways of describing the universe, or else to show that some of the ways have some slight spots that are inconsistent.

b. "Science" is also merely that more or less formal use of everyday ways of describing. Perhaps the most usual such "mechanical theory" is called the molecular or atomic theory, or the kinetic theory. (There is a technical distinction between the molecular theory and the atomic theory; but as it is one merely of order or relative sizes of structures [provided the fact is recognized that atoms are splittable] it is not essential, and I shall not notice it very explicitly; §100.) In the kinetic theory, "matter" in general, or the One, is divided into parts, related by force. The assumed ultimate parts are named atoms in the older, explicit kinetic theories. —— (In actual fact, not conventionally always recognized, nearly always the kinetic or atomistic or 'Many' theories are accompanied by and explicitly *mixed* with logically different theories:- fluid or 'continuous,' or 'One' theories—just as orthodox theology is a hodgepodge of pagan polytheism, Pauline dualism, and a trifle of Christianity. Rigorously consistent—although never absolutely quantitatively accurate—kinetic theories are possible, in which the parts for convenience and greater accuracy are smaller than atoms or electrons; examples are Reynolds's in §91, and Reeves's in §92. I shall omit further explicit mention of such contradictory fluid theories included secondarily in kinetic theories until §93.) In the kinetic theory the atoms are in relative

motion—as by the truism of 'dividing' they must be (§80). —— The other general conventional mechanical theory is the electron theory. It was observed that we could perceive or measure a more minute splitting of matter than that formerly described by atoms. So the atoms were said to be made up of smaller parts, now usually called electrons. —— That obviously implies the logical possibility of further splitting of electrons—an infinite regress of structures and of "theories." As a matter of fact, we shall see that light (say) is electrons split up (XIII). That is a matter of naming. We may note at once the formal or logical truism that all the various controversies as to whether atoms are "real" or not, are rather irrelevant. Atoms are obviously Many entities (or names of them), and by everyday valid logic (§49j-l) are "real"—that "reality" being itself based on verbal agreements. But atoms are not "constant" or fixed or eternal; e. g., both by verbal truisms and by actual weighings of some sorts of atoms, atomic weights are variable. And of course, as being merely the remainder of the same verbal truism, *all* properties of atoms vary just as weight varies, but not in any fixed proportionality; or, there are no *absolute* "elements," with eternally absolute, fixed properties; atomic weight is merely the property of atoms formerly used to distinguish "different" atoms apart. Obviously, the controversies as to the reality of atoms were actually controversies concerning the verbal trick of the One and Many.

c. Therefore, conventional atomic or molecular theories are as varied as conventional theories of the Trinity or "systems" of philosophy—and for precisely the same reasons. For some details showing that, and showing that Maxwell substantially understood that the One and the Many was involved, see "Ency. Brit.," Art. "Molecule." As a rough sort of statement, it may be held that there are three general sorts of conventional kinetic theories (described in this and the next two paragraphs):- (1) The oldest one, definitely compiled by Democritus over two thousand years ago, was that matter was absolutely divided into small parts named atoms, and that each atom had the absolute character of a One or universe. The God which related those atoms was usually named force—but was not explicitly recognized as an *identifying* relationship. That God *force* was obviously "there," but was more or less denied by Democritus's classical logic. That old form of the kinetic theory is held and stated by Maxwell (in a notorious address; Glazebrook, "James Clerk Maxwell and Modern Physics," 82):- "They [molecules; or atoms, as we would now technically say] continue this day as they were created—perfect in number and measure and weight; and from the ineffaceable characters impressed on them we may learn that those aspirations after accuracy in measurement, and justice in action, which we reckon among our noblest attributes as men, are ours because they are essential constituents of the image of Him who in the beginning created, not only the heaven and the earth, but the materials of which heaven and earth consist." The reader who has followed the solution of the One and Many will recognize that as being dualism and materialism, and also the conventional theological myth. It would be difficult to cram more nonsense into a passage of equal length. It is as bad from an ethical standpoint (XVIII)—as is directly evidenced by its term "aspirations," which means weakly and futilely merely having good intentions, instead of going and doing it, whatever it is. But logically it is possible to construct a valid theory of an *absolute* Many which is infinite (§§91-2).

d. (2) The next form of the kinetic theory is that vaguely put into form by Van der Waals (§82). In it the atoms were no longer actually sharp and fixed and eternal. They had "fields of force" (possibly first formulated by Faraday) which vaguely were variable, and which were more or less formally actually unified with each other, under the assertion that they produced, or were, *pressure*. There was a rough guess that beyond a small fraction of an inch from an atom (whatever that may mean) gravity attraction took place; closer to the "atom" than that, vaguely there was an opposite force of repulsion. Nothing was very definitely said as to how atoms were pulled together in (say) a solid.

e. (3) The most modern form of the kinetic theory is Richards's (§82). He correctly asserts that his theory contradicts the logic of the two just mentioned. He has atoms which are also explicitly variable in volume, so that we have the explicit form $p...\times v...$, or *That*$...\times$*This*.... It would consistently follow (although so far as I know, Richards does not assert it), that his atoms would or could include, as being parts of themselves, the vague fields of the Van der Waals form. If so, then atoms would truistically or logically be continuously *touching* each other, and not be on an average at relatively considerable distances apart as they move about colliding; in any case they truistically could not have a constant boundary or absolutely fixed 'skin' of some undescribed sort, as in the other two theories. And that continuity obviously wipes out the Maxwell sort of "reality" of atoms, and the One and Many again definitely bobs up for solution. —— In short, the kinetic theory in its modern form works around to a destruction of the "explanatory" *names* it started with centuries ago. As a well known fact (Art. "Molecules"), the kinetic theory is explicitly called the kinetic theory of gases, because only in gases where the "fields" of the atoms are relatively very weak are there any even approximate measures indicating any apparent separation of the atoms. I. e., any rigorous kinetic theory—any actual dualism such as Maxwell strives for—requires that *every thing* in the universe be a perfect gas, and no perfect gas has yet been found anywhere, or ever will be (except that the One is a perfect gas, if we care to say so). Hence Richards finishes the complete swing around the logical circle, and by using a kinetic theory denies any dualism. So it is obvious that to give explicit names to the details of Richards's theory, some unconventional novelties will be required. It happens that Reynolds and Reeve and others formulate such novel theories, as we shall see.

f. The reader will note that orthodox science has thus, under the *single name* of kinetic theories, shifted all around the Trinity, just as we saw theology and philosophy doing (VI), and for the same reasons. And then, about twenty years ago it was observed that atoms themselves were formally splittable—explicitly, that certain phenomena which appeared definitely with our improved seeing were consistently describable in everyday language only in terms of *parts* of atoms. The necessary repetition of the verbal inverse square law for such splittings had been made only in electricity (IX). So that splitting of atoms into "corpuscles" was expressed in terms of electricity, and the quantity of electricity in or on one such part was said to be a natural unit of electricity and was named an *electron*. The term *electron* was afterwards usually applied also to the parts themselves—which of course logically implies that electricity and "matter" are identical, and that an "electrical force" residing in or on a particle *is* such a "material" particle—in short, that the only relationship is identity. However, orthodox science perhaps tends to assert that electrons are "constant" or fixed like Maxwell's atoms, and are all of the same size: such a view would clearly be logically incorrect (for details see next paragraph, and for concrete proof of the incorrectness see §137). —— Consequently, as the atom was now split, the kinetic theories had to be split. There

obviously were none of Maxwell's perfect, eternal atoms. So all the various kinetic theories of the day were shifted to include *parts* of atoms. That was mostly done in general by writing *electron* instead of *atom*.

g. The atoms by older kinetic theories were not all of the same mass or weight (e. g., C weighed about 12 times as much as H), although by Avogadro's law they were of approximately the same volume when in a gaseous condition (or at least molecules were); whereas electrons at first were all supposed to be of the same mass, with nothing definite asserted about their volume. Therefore, in order to write *electron* for *atom*, so that in terms of mass $Atom/x=Electron$, a different x had to be used for each element, on the assumption that an element atom had a constant weight (which it had not); x for H was variously observed to have values from 1000 to 2000, but it was orthodoxly tacitly assumed that it was some "constant" value. However, some physicists in effect claimed that for x to have a different but "constant" value for each element made no difference in the logic, and that the same kinetic dualistic logic still held. It would still hold, as a truism, *if* the kinetic logic had *experimentally* held with reference to (say) solids; but the kinetic logic admittedly had not held there. That of course confused the whole matter; for there was no knowledge as to whether electrons formed a "gas," or "solid," etc. —— And there arose another complication in the electron theories, which corresponded to the (1) attractions and (2) repulsions in the later kinetic theories:- there were orthodoxly two "kinds" of electricity; an electron was "negative" electricity, and no one was able to find a "positive" electron for a while, and then it was finally decided that an "electrified" atom would serve. So the logic was more confused.

h. However, J. J. Thomson rather substantially cleared the puzzles of that shift from atoms to electrons by asserting Faraday's tubes of force as existing, and extending from negative electrons to positive electrons (and vice versa, of course; "circularly," or as a One). Those tubes (which fundamentally were merely a convenient verbal trick) are obviously equivalent to a relationship, and at the same time assert that electricity is structural, or is matter in a Many or mechanical sense. As the original kinetic theory is *not* structural (i. e., only an asserted metaphysical capricious God holds its eternally perfect atoms together), Thomson's form of electron theory is obviously identical in principle with Richards's modern or valid kinetic theory. Possibly most of the leading physicists now hold Thompson's form. But some do not like calling a relationship a tube or an ether string, and refuse to do so. But they follow substantially the same consistent logic or mechanics, leaving it largely tacit and unexpressed. It would be difficult to say just how many sorts of electron theories there are now—they are more numerous than philosophical idealisms, and as mutually contradictory. Some physicists seem to hold that an electron can not be further split. Others seem to hold that an electron absorbs and gives off by "radiation" (whatever that may be) a fixed or definite "quantum" of energy; that amount, or very small M, would obviously, as a truism, imply a structural splitting of the electron, but it is not clear whether they mean in infinite regress. (For further details, see Millikan, "The Electron Theory," X; also XIV this book.)

i. Obviously, the formal kinetic and electron theories logically consider parts of the universe to be what is usually meant by the name, "rigid molar bodies." Thus, the non-Thomson electron is formally a rigid body or M, which moves as a *whole*; and a "quantum" of energy seems to be held to be a whole rigid M even smaller. And so truistically there must be some *absolutely* "free" space about those bodies, as otherwise they would be "blocked in" solidly like the bricks in a wall, and so could not be "kinetic." That absolutely "free" space also serves as a formal means of separating or distinguishing the parts. But then, such orthodox dualism having "separated" the parts absolutely, it promptly wants them together again, or related—and proceeds formally to abolish that "free" space (except for some now discredited theories which have an infinite "sink" for energy, and a similar infinite "source," as a One at the "Beginning" and the "End" corresponding to the theologians' God—which theories we need not consider explicitly). And at the same time, more careful observation shows that those "constant" M's are not experimentally constant or "rigid," but that continually a regress of smaller splittings is being perceived. Clearly, science must definitely use the solution of the One and Many to escape those contradictions. —— We may further note that invariably the first class scientists who see things as they are pretty well, show that the various Many M's are really continuous or universally related—that an effect must have a cause; that no miracles occur; that God is love, or that *real* religion or continuity is true. E. g., the essential of Darwin's work, the fundamental principle which caused so much disturbance, was that he proved that man was *not* sharply and dualistically and aristocratically cut off from the rest of the universe, but was directly related to all the living things we know (the theologians would have it that man was a specially privileged aristocrat essentially superior to "animals," who thus could and did get something for nothing, etc.); Newton's gravity (although formally crammed so with the logical dualism of his time as to be technically wrong) according to the practical, actual understanding of it asserted the absolute universal relationship of all things (again contradicting the dualistic theologians, who insisted that the earth was a specially privileged place—that nature faking being intuitively felt to justify their grabbed privileges). Christ substantially asserted the real relationship or continuity of all things—taught a valid religion (XVIII). And Paul and the ecclesiastics stole the name Christianity, but shifted back to dualism. Always heretofore in history, the mediocre, short-sighted men who are unable to see things clearly, fail to observe the connection of things, assert that the Many is *sharply* split up (and hence miraculous, and not subject to cause and effect), and slump back into dualism. So in practice those fools fancy they can get something for nothing, and start grabbing or profiteering—are selfish, to use the antique term,—and resent even the verbal interference of the clearer-seeing men.

j. It thus becomes obvious that there has heretofore been a struggle in science over the One and Many, as to whether the smallest arbitrary parts of matter (e. g., atoms) were continuous with each other and hence severally variable or were absolutely hard, fixed, constant, eternal. If those parts were constant—if there were *any* constant thing in nature—then they were obviously truistically *essentially* internally without motion, or absolutely "dead"—as witness the old idea of "dead matter," or Maxwell's. And that started a dualism between mind and matter (cf. §150). And invariably, the scientists who were instinctively recognized, even by the dualists, as being the best, in order to agree with what they saw and speak everyday language had to make those parts of matter variable or continuous or "alive"; Maxwell himself did it in electricity, in which he was guided by the first class *observations* of Faraday and Cavendish.

k. However, unless there *were* natural "constants," or fixed (say) atoms, then the infinite regress appeared. So the second class men, rather than enter upon continual efforts to achieve greater accuracy and obtain knowledge of more and

more details—finer and finer splittings,—would begin to drop any continuous, variable atoms and thus dodge the need to consider or "*measure*" cause and effect very far (and of course they simultaneously filled the air with the talk we hear so much of, about science being "accurate" measurements, etc.; for the psychological reasons for that surplus of such talk see §155). Obviously, all the ups and downs of science are simply exhibitions of ordinary human nature, as will implicitly appear in Part Three. The problem of what is "really" inside an "atom" is largely a problem of what is inside the men who talk of atoms. The dualist is the lazy, mediocre (compared with present day standards), "empty" man who would put knowledge up in neat little finished, constant, stand-pat parcels like Maxwell's "eternal" atoms that were dead or "empty" inside like himself except in electricity. Such dualists have the sort of brains that cause business men to say that "brains are cheap." The dualists fail to see deeply enough into things to see that principles—the complete and consistent truisms of the One and Many—are the eternal things, and that parts of the Many are merely arbitrary and changing. All shallow, superficial observers will continue to prefer to be dualists—to have fixed atoms. In society they also want delusions as to fixed things; so they assert fixed classes and are aristocrats themselves:- i. e., they consider themselves the "best," and fixedly so by a "Divine Providence" or a miracle, without special effort on their part, whether that "best" be the too-rich, or slum or near-slum dwellers—there are many more aristocrats among incompetent or grabbing workmen than among dwellers in mansions. Always they fancy that they can get some privilege—a sinecure, light work, a "soft snap," something for nothing,—beat the game in some way by refusing to see cause and effect, or the universal relationship of identity (for proof in details, and the showing of how dualists do pay—"out of their skins"—see the last two chapters).

§90. a. The solution of the One and Many at once gives us the solution of the centuries-old puzzle of how to name atoms and their smaller parts. Whatever parts of the One which we do name are logically, as such names, *positively* definite as units of the Many. I. e., *any M* is, *as such M*, *positive* and *definite*, which means *verbally* "hard, rigid, and fixed"; it does not mean actually or really constant or that the *M* is itself absolutely dead or motionless inside. I. e., the mere *names* of the parts of the Many are *not* the actual *parts*. Consequently, as a completely general solution, we divide the whole universe into verbal parts *which are small enough to permit statement of all the actual variations we can perceive*. If we divide electrons into very small parts, say parts small enough to give some millions of them in each electron, then *for the present day* they are going to be about accurate enough to state all that we can *perceive*. As we learn to use our senses better, aiding them with better tools, our perceptions will become more delicate—"improve,"—and we shall have to use smaller parts. The same thing applies to any aspect of society: given a steady climate we continually need more delicate legal laws (XIX).

b. Then, those smaller parts will *formally* be constant—M_e's. But by the very nature of language, if we assert that they are *absolutely* constant, then they will truistically give absolutely no motion. E. g., Maxwell's hard atoms were supposed to be perfectly elastic, so that they would bounce off each other perfectly to give a perfect gas; but obviously, if they were perfectly elastic then there was absolutely frictionless mutual motion of an infinite number of zero-size *parts* of such atoms; and hence, instead of their being fixed and hard they really were ineffable Ones which equally truly had absolutely no rigidity or hardness. So just as we saw in the problem of the One and Many (IV), there is necessarily always a *formal* contradiction at the base of science.

c. And orthodox science, as we have seen, nowadays tacitly and validly uses *positively* that verbally smallest part in two ways:- (1) Richards' atoms are *compressible*, so that by the usual kinetic theory the parts of those atoms have fields, or a *variable* boundary; (2) Thomson's electrons have tubes of force which also are truistically variable, and that is obviously equivalent to Richards's atoms, with possibly even more explicitness as to the existence of internal structure.

d. Clearly those two widely accepted modern theories are valid—being ways of expressing *That...×This...*. But because conventional science does not explicitly state the logic of the two, they are unfinished in that respect and contain various minor errors. But there is one grave practical objection to them:- They are exceedingly vague as to what a "field" or a "tube" is: those two things are not described in detail—their "mechanics" are not given. All the explicit phenomena of the universe are explicit motions of or in those fields or tubes, and those motions are not described. In that sense orthodox science is as "spiritual" and "idealistic" or half-baked as can be fancied. It is a defect that those fields and tubes are far too mystic and intangible—are a sort of soft fog of "thought." It is quite true that ultimately all so-called matter in the conventional "dead" sense does disappear as being a mistake, when things are closely observed. But when orthodox science permits "matter" to disappear as those intangible fields or tubes before they are ever arbitrarily described as machines, then science itself is becoming a bit too precipitate in shifting to One mysticism or poetry or religion. We must shift or sum to that in the end: but if we use language at all we are by agreement constrained to be definite and intelligible (i. e., positive and pluralistic) on the road to mysticism, so that when we get there we shall actually understand it, and not be at the mercy of the various intellectual exploiters—or, if we are biologically vigorous, will not ourselves become such exploiters.

e. So although the modern theories are correct in principle, and although I shall therefore continually use them in this Part, we need to get a mechanical model which is rather more definite about those fields—about the formal and variable boundary or difference surface of the positive verbal parts of the Many. I shall use vortex whirls—which are easy to use as soon as we experimentally note their fundamental or characteristic reaction, which seems to have previously been overlooked (§98). —— But various other men have tacitly recognized just what we have explicitly seen above was needed in physical descriptions and "theories," and have therefore validly devised in more or less completeness various mechanical models of the universe. We briefly consider such descriptions in the rest of this chapter.

§91. a. Reynolds (in the books cited, §84c) devises a mechanical theory which he claims is the only possible one. He does use the only correct principle (see par. d), and in that essential sense justifies his claim. But he does it in a *way* which turns ordinary language upside down, and gives a weird description. He takes, as a verbal unit of the Many, very small, perfectly smooth spheres, perfectly hard, and in themselves perfectly inelastic. Those spheres or "*grains*" are all piled together like a heap of marbles, to make the universe. Consequently the total universe holds them together, as a *verbal* truism (there is nothing inside to push one out of the universe, or outside to pull one out, as will become obvious). That relationship of holding-together he *verbally* names from the point of view of the "outside," and hence calls *pressure*. We usually name the relationship that holds things together as a force which *pulls* them together (towards

us, as a center or standard inside), and not one which like Reynolds's pushes them together. Thus, Reynolds, by not imagining *himself* as the center of things, verbally largely got rid of the evils of anthropocentricism or "constants." But by not being a center he got his *names* usually backwards, or in the opposite direction from ordinary conventions.

b. It is also immediately obvious that Reynolds's *grains* or the *units* of his Many, are thus verbally taken as absolute and not variable. His total universe or One would be variable, as will be seen. Hence, Reynolds has what is explicitly an infinite pluralism, and it is in general valid, and essentially equivalent to our everyday principles, but with the verbal agreements reversed. —— It is to be noted that his grains are not atoms, or any other things actually observable directly with our eyes or tools: in his infinite pluralism those observable things are still variable and his grains have to be much smaller to provide for such variation. He calls his spheres "anything or nothing"—i. e., 0 or ∞ ("Sub-Mech.," 88). Only such a series of truisms is consistently possible even in an infinite pluralism (cf. §90). —— And because Reynolds's are thus the reverse of our usual agreements, he therefore gets some odd namings, which are so strange and unfamiliar that the burden of them on his memory finally trips even himself in logic (par. d).

c. If spheres be piled together as closely as they will go, they fit together as roughly shown in one plane in Fig. 91c$_1$, which is called *normal piling* by Reynolds. (Specifically, in normal piling, each grain touches 12 other grains.) If the grains be slipped up ("dislocated") out of the hollows between themselves, as in Fig. 91c$_2$, they obviously take up additional space, and are said to "dilate," and the piling is "abnormal," and the "surface" between them is a difference surface or zone which Reynolds names "a singular surface of misfit." In Fig. 91c$_2$ the unoccupied space between the grains is shown as the greatest possible (i. e., the grains would be tangent to the plane shown by the dotted line), and the grains have maximum "dilatancy." Now, obviously, if in the total universe of grains any misfit occurs (and by the theory of incommensurables, §50, there *must* be a misfit;—so far as I can judge Reynolds does not explicitly make just this point, but obviously by it his universe, as a mere verbal truism, must logically "work"), then by the truism of symmetry (which is the same as the theory of incommensurables) the misfit *moves* through the otherwise more or less stationary grains. Such misfit "surfaces" are the "surfaces" of atoms, and the motion of those surfaces (involving changes in the *degree* of misfit) obviously will cause the atoms to move as a whole and to vary and split in various ways (or join in various ways), and thus produce all phenomena. —— So it is clearly truistic that in Reynolds's grain theory atoms are "anything or nothing" bounded by misfits which consist of larger *absolute* vacuums than occur elsewhere: i. e., the misfit "surface" in Fig. 91c$_2$ is merely more of empty space than is between the grains in the close or normal piling in Fig. 91c$_1$. The "working" or essential part of "matter" hence is absolute vacuums, and those vacuums are the only "things" that move molarly. —— Such a theory, although odd, is obviously quite consistent. It is concretely illustrated by Reynolds:- If you step on wet sand the water is not squeezed out from under your foot, making the sand around your shoe appear wetter than that underneath at the moment of removing your foot. On the contrary, the *surrounding* sand is pulled into abnormal piling, and more water is needed to fill its larger chinks, and that surrounding sand thus seems to dry out because surface water is pulled into those chinks.

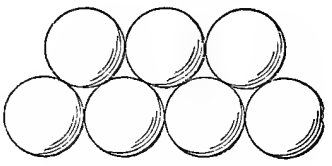


Fig. 91c$_1$.

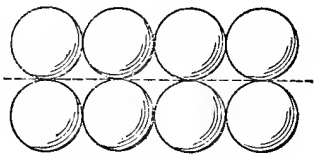


Fig. 91c$_2$.

d. In the grain theory the actual smallest part is the (ultimately arbitrarily) fixed grain *plus* its proportional share of the *variable* absolute vacuum or "field" about it (hence, a grain explicitly has *both* the absolute rigidity *and* the absolute elasticity that are actually required by Maxwell's atoms if they were *consistently* infinitely pluralistic; §90b). Thus, the formal agreement that the rigid grains "touch," throws the *variability* off his absolute Many onto the *variable One*—as Reynolds seems to recognize (the touching of the grains obviously serves to make the variable fields definite, thus correcting the practical weak point in kinetic theories; §90d). The actual result is that although he corrected the old kinetic theory, he himself, thus headed right, got confused by that variable One, which is obviously verbally the reverse of our ordinary verbal fixed, steady, "perfect" One, and asserted what seems to be the ordinary nonsensical increase of entropy. However, he stopped there, apparently recognizing that something had gone wrong, and did not mix such an error with the rest of his work.

e. His brief non-mathematical statement of his theory in the "On an Inversion of Ideas, etc." is more easily intelligible than my mere hints here. His statement in "Sub-Mechanics" is an extended mathematical analysis which I can not surely follow—nor was it worth while trying very hard, as technical calculus in general has to be revised to become logical. But any good mathematical physicist ought to be able now to translate it into intelligible, sure-footed equations. One immense advantage of his queer theory, in which "matter" is substantially holes in the ether (i. e., in the collection of grains) is that its user is not disturbed by preconceived notions; for he would not quite recognize the conclusions until he translated them into ordinary terms.

f. Reynolds found that Newton's law of gravity was wrong. He corrected it, and apparently got a result equivalent to the law as given in this book, although as just implied, I have not translated it. He gave one correct mechanical description of how gravity works. So far as I find, he was the first to devise such a correct description with fair definiteness. Five or six men have since independently devised correct mechanics, all finally equivalent (§134).

§92. a. Reeve in "Energy" devises a working or practical 'smallest part' which consists of at least two bodies which are in effect simply two masses or M's that are condensed to geometrical points and have a formal "field of force" which (by the forms of our ordinary language) is an attraction or relationship that varies as the inverse square—is simply 'pure space' or an absolute vacuum. Therefore, his logical or verbal smallest part is the solid, rigid absolute point, *plus* the *variable* field regulated in measurements by assigned "mass" of its point-body; that smallest unit part thus is logically equivalent to Reynolds's grain plus its field (§91d), with the modification that Reeve's parts can be assigned various differing values so that his One is fixed as in ordinary language (and then, to take care of the mechanics of such phenomena as gravity, light, etc., Reeve would have to have, what he omits:- an infinite regress of different orders of structures in each part or structure—a remark intelligible when this Part is grasped). Clearly, Reeve has the

formal contradiction of the One and Many tacitly contained completely in that mechanical model, with ∞ in elasticity of field and 0 in the absolutely rigid point-masses as verbal agreements. As the logic was valid in that it was balanced, he got generally valid conclusions so far as he went with his theory, which definitely included only heat.

b. The objection to Reeve's theory, other than its incompleteness, is that a 'part of the universe' that is substantially a point and a "pure field" is not very concrete or subject to direct experiment. But Reeve's book is a *formal* valid statement in everyday language of the kinetic theory (it rejects the old one explicitly), and was written several years before Richards independently by direct experiments on atoms found the compressible atoms which Reeve showed must exist by consistently using everyday language in describing other observed facts. With that comparison in mind the reader can readily complete Reeve's book to any desired extent. In fact, I first began explicitly and deliberately to write this book in 1910 by expanding Reeve's. It took me about three months to work out the mechanics of gravity with that start; and I got the whole argument of this book in a rough way from Reeve, being assisted by other valid theories which I found from year to year later on.

§93. a. It has been seen that kinetic theories are usually accompanied by mutually contradictory fluid or continuous One theories. I. e., there were observed to be what science called waves of light, and afterwards electrical waves, heat waves, etc.; and when the theories had their 'smallest part' equivalent to an atom (or even to an electron) such parts failed to be small enough to serve as *parts* of such so-called *waves*. Therefore, science assumed (ultimately, it was a mere verbal 'existence assumption': §22) that there is a *continuous fluid* (conveniently named *ether*), actually unsplittable just as the formal One is, which served to transmit, or be, "waves." That One or ether of course with rather glaring obviousness contradicted the Many atoms or electrons and scientists have made efforts for centuries to get some consistency between that One (or ether), and the Many (or electrons, atoms, quantums, etc.). Clearly, that One ether when strictly considered as *perfectly* continuous or homogeneous is not "mechanical" at all, as it is not possible to make a machine out of one part. (E. g., Reynolds's and Reeve's "fields" of their rigid masses is-are really logically that ordinary continuous ether.) Yet in order to "describe" waves the ether had to be split into at-least-formal parts. So the physicists vaguely admitted that necessity of language itself by saying that the ether is "elastic," and more or less ignored the fact that elasticity implies parts. And then that One ether, in the logical manner of the One, also caused the physicists trouble by sometimes insisting on approaching zero (as when it *directly* gives excessively slight resistance to the earth's movement), and at the same time on approaching an infinitely dense solid (which is the only thing that will transmit a light wave as orthodoxly described; XIII).

b. The last paragraph shows the general total difficulty science had with "ether," and its source. Ether is nothing more than a *name* for "substance," or "matter," or whatever it is we talk about. In philosophical technicality the name *ether* is the name *Being*, and the "philosophical" science of ether, or Being, or of the question Does the universe 'Be' or exist?, is called *ontology* (§§22, 60, 142, 161). When science was naming or considering the Many "matter" (or atoms, electrons, etc.), and ether a continuity or a One, there was obviously an irreconcilable formal contradiction between ether and matter, and ontology or Being or ether became also a formidable "scientific" problem totally insolvable until explicit statement of lingual agreements was made —as the problem obviously is that of just such agreements.

c. Also, conventionally *ether* often became substantially the name for a universal relationship (such as L is used for in this book). Thus, Newton in a vague sort of way recognized that *force* essentially asserted a relationship between the various M's, and that the only possible relationship was that of continuity or absolute "touching," or really identity in the end. He indicated that recognition by insisting on what is ultimately merely a truism (of everyday language; §77a), that action at a distance is inconceivable—or that force can not travel over absolutely blank space. So *ether* was often used merely as *Being*, in the "pure" sense of relationship to fill "empty" space so that force could exist or Be (*Being* in conventional philosophy is also similarly thus confused between the three parts of the Trinity; apart from that *verbal* carelessness, "Being" is no problem at all). So obviously ether is a verbal or logical problem. Science has talked almost as much about ether as philosophy has talked about Being—and as futilely so long as the One and Many was unsolved. "Ether" is said to be, or belong to, "science"; but obviously that does not make it actually any different from "Being" merely because "being" is called philosophy, or from "God" because God is called religion.

d. The immediate solution of the actual (i. e., *verbal*) problem of the ether is obviously therefore to say that ether also will be given mechanical structure—i. e., will be verbally split into parts, so that it will *as a whole* or when considered as a One be the universe or God or *Energy* and really absolutely continuous; but that when we talk *positively* of it, it will be split into parts (also, it can be used as a relationship name, when properly so designated). Ether is therefore matter. In this Part Two I usually use both terms as Many words, with the infinite regress.

e. Reynolds named all the universe or Being *ether*, and arbitrarily split it into parts that were always touching, which parts or grains were small enough to be used as verbal counters that would "outline," or 'construct,' or constitute a "structure" or form or "mechanics," for any phenomenon. Those grains were finite, and did not *explicitly* take care of the *in*finite regress. Therefore, that regress or ultimate formal accuracy, and the explicit logic, was included in the *field* of the grain (which formally was a 'second' ether, implying an infinite regress of ethers or splittable Being). And obviously Reeve implied substantially the same thing (§92a).

f. It is therefore definitely obvious that when scientists use any sort of elastic ether, or other elastic Substance such as Richards's "compressible atoms" (whatever those may be verbally "made of"), they are tacitly making the 'existence assumption' of "Being" or substance or matter or the One, and are further tacitly asserting that it is split into arbitrary parts in infinite regress. *For elasticity can not possibly be verbally asserted without truistically implying a relative motion or verbal separability of internal parts.* In orthodox science such elasticity is usually taken as "perfect"—i. e., is given values of 0 or ∞ as happens to be convenient to keep names from obviously reversing. Such elasticity is of course pure One, or mysticism. It is quite true religiously or ultimately, but violates the agreements that science as such will talk a *positive* language of finite bodies which hence is directly verifiable experimentally.

g. It also follows that all of "science" which treats of any sort of wave motion in any sort of "perfect" medium is not specifically science, but is religion. I. e., orthodox light and analogous subjects are monistic, and contradictory to atoms or electrons. Also, that orthodox light is invariably quantitatively inaccurate (XIII)—just as Newton's law is, and for precisely the same reasons.

h. As a result of such confusions in the One and Many in previous science, it naturally is difficult to say just what is the general character of sciences which treat of fluids—of light, hydromechanics, ether mechanics, etc. The descriptions frequently use zeros and infinities, just as if they were talking of the One; but they also consider a fluid as made up of relatively moving finite parts. Obviously, there is no *explicit* consistency in such ether mechanics; they solve the One and Many by tacitly using the everyday valid logic—and no clearly nonsensical conclusion is written down, although as we shall see, some conclusions are written that are obvious nonsense in the light of explicit logic.

§94. a. We may now consider two excellent fluid theories of the universe. The first one, Marion Erwin's "The Universe and the Atom" (1916), claims to be a general description of the universe. The second one, V. F. K. Bjerknes's "Fields of Force," with considerable parade of "modesty" avoids claiming to do anything in particular. Bjerknes gives a fine fluid theory, universally applicable (and I suspect that he is intelligent enough to know it—in contradiction to that "modesty"). In another book he gives a mechanics of gravity; I have not seen that gravity description, but as it would be but a trifling and obvious step beyond "Fields of Force," I judge it is substantially valid.

b. Erwin says in effect (ibid., pp. 14, 20) that he holds to both dualism and continuity, and throughout his theory he formally has that logical hodgepodge (the existence of the similar one in conventional science has been noticed in §93h; Bjerknes formally, but not explicitly, has the same mixture). However, Erwin tacitly uses our valid logic in spite of the contradictions and vaguenesses he writes down, and gets his theory without much important error—working out a valid mechanics of ether which gives a structure of matter and a mechanics of gravity, light, and electricity.

c. Erwin starts his theory by assuming (as a verbal name of Being) an ether. He then takes it (p. 16) that his ether is (1) "structureless" and "non-elastic," and is also (2) "capable of indefinite subdivision"—which is of course logically self-contradictory. He actually does use ether "particles" as his 'smallest part,' which particles (p. 6) are to be considered as not solid, but actually as a sort of elastic eddy or center of gyration; such infinite and zero elasticity follows because (p. 16) the parts move over each other frictionlessly. —— That is obviously a logical mess when I thus mercilessly set it down in parallel columns. But it is *logically* precisely the ether used in textbook physics: and as I said before, Erwin by a powerful and intelligent use of valid everyday logic, or commonsense, steers a fairly safe course through the confusion—that confusion being merely his superficial use of dualistic logic. Perhaps the only mistake of consequence which he makes is that he asserts that different sorts of light travel at the same speed in "free" space; he seems to have copied that out of the textbooks without investigating it much himself (see §127).

d. He then begins his intelligible, detailed description of the universe by showing (p. 18) that because his ether is continuous, the particles are like bricks in a wall, and certain given ones can move only if other particles take their places—so that finally all motion in the ether is effectually in closed paths ('circular,' like valid logic), or *is rotation*. —— That is simple enough, although it usually is not observed or stated. Reynolds of course always in direct effect uses that proposition. Also, it necessitates that either there be somewhere some *absolute vacuum* serving logically as an elastic field (as in Reynolds's theory), or else that the particles themselves be elastic (i. e., formally divisible in infinite regress); for otherwise there can not be motion (cf. Index, "Zeno's paradoxes"). Also all of those considerations obviously introduce the formal verbal contradiction of the One and Many—and valid logic requires that they should. Also, if we apply that fact that the ether "rotates" to the trick of using words, it directly gives us the analogous conclusion or truism that all valid logic is 'rotational' or circular.

e. Therefore, Erwin builds up atoms by making the ether particles rotate. They explicitly rotate in all three dimensions of space, *and that explicitness* keeps him consistent with facts usually. Each rotating particle or "*wheel*" is obviously truistically elastic. Also, a "wheel" in turn can and does act as a particle itself by *revolving* along the circumference of a circle which passes always through the center of that wheel at right angles (that is a formal, perfect One statement, given as Erwin gives it, which contains inaccuracies). And that larger wheel is a 'part' of a "higher" order structure—which means in the terms I have been using that the large wheel is, *relatively* speaking, static, and the lower order wheel moving along its circumference is dynamic (as, besides rotating about its own center, it explicitly moves as a whole). And that large wheel can in turn also revolve as a particle in a wheel of a still higher order—and so on. In that way Erwin automatically or mechanically introduces the essential verbal inverse square form. Consequently, he can go from one phenomenon to any other mechanically, so that he tacitly does unify them in spite of his dualistic logic. Or, what amounts to the same thing, he by that mechanical device introduces the infinite regress into *all* structures. He himself explicitly asserts the equivalent of that infinite regress on p. 78, and often elsewhere less positively. Hence, his perfect circular paths are mere verbal forms; in actuality that infinite regress makes all his circles or wheels vary from such perfection, or from such zero-infinity talk, and he definitely has *That...*$\times$*This...*, and he himself occasionally says so in effect.

f. The reader may thus see in general how Erwin gets a valid mechanical model which in the end is formally consistent. Although it is nominally a fluid or ether theory, it actually is kinetic in that to the very ultimate the universe is divided into parts. In that ultimate, or with such infinite regress, 'fluid' and 'kinetic' are obviously identical.

g. Now, Bjerknes in his "Fields of Force" does not say anything very definite about atoms or ether: he asserts "analogies." An *analogy* is of course in customary meaning a similarity of relationships among at least two sets of things or circumstances. Obviously, if there *is* a similarity, as the word *analogy* asserts, then there can be only one sort of similarity, and that is flatly an ultimate identity (§28h, etc.). So a valid analogy is, by valid logic, that valid logic itself. Therefore, if Bjerknes's claimed "analogies" are valid (and they obviously are), then he actually has unified the various phenomena he describes by means of them. Also, as he deals with electrical "fields" of force, he essentially is dealing with atoms (XIV), whether he says so or not.[94g]

[94g] I am quite aware that it is customary for people who do not wish to be held responsible for their logic to say that they state an analogy. I have merely pointed out that by any valid logic an actual analogy *is* valid logic. Probably the most sensible way to be relieved of responsibility for one's logic is explicitly to disclaim such responsibility—in which case it is obvious that usually the ethical, wisest course is to keep silent, that sort of silence having long been praised as "golden." Bjerknes has the "modest" habit of "registering" what perhaps he thinks is proper scientific caution by verbally dodging saying anything in particular (if he were not really a first class thinker, with a highly valuable theory that is sound apart from that "modest," "cautious" ducking, this book would ignore him). By using a little valid logic I have rigorously pinned him down to saying something explicit, as a necessary preliminary to considering his theory; to do that is always easily possible with such

h. Bjerknes uses vibrating, pulsating, or oscillating bodies—i. e., he uses bodies that tacitly are fluid, and which change shape continuously, or are elastic. Vibration, oscillation, and pulsation are merely names for what finally is rotating motion: Bjerknes takes the whole of our par. d for granted. He then proceeds by using a pulsator as a body inside a fluid, and deduces the "fields" in the whole fluid, as far as he can take the mathematics before they become too complicated (he uses vector analysis, which is pretty complicated to begin with, and has buried deep in it the orthodox confusions as to the One and Many). The pulsator *plus* its field is obviously *experimentally* identical with one of Richards's compressible atoms, or one electron *and* its tubes, or with any elastic "kinetic" part. And in proof of that fact (which fact he only implies), Bjerknes shows that actual pulsators, vibrators, etc., act just as do "natural" phenomena; and that the mathematical statement of them is equivalent to the usual mathematical statement of electricity.

i. Bjerknes explicitly has a serious difficulty (ibid., p. 122). He can make his mathematics for vibrators agree with experiments and correspond either to static electricity or to magnetic (dynamic) electricity. But he can not mathematically consistently pass from one to another. And he obviously would get into that difficulty, because his phenomena are all of the same order. I. e., he keeps his vibrators all either static or dynamic; or, there is no explicit mutual motion of the *vibrators as wholes* which is of the same order as the motions of the fields. If he had given such very rapid motion to some vibrators as wholes, as we saw Erwin in effect doing in par. e, the verbal inverse square law would have been introduced, and he could have completely unified phenomena—including explicitly the infinite regress in his expression of the unification.

§95. a. There are many other historical physical theories—descriptions of the universe in the mechanical or mutually named form of *That...×This...*. Our everyday talk is in that form; e. g., we "classify" or relate certain things and name them *paper*, and use that with another factor, (say) *cloth*; or again, we similarly assert some meaning about *Plants...×Animals...*. But as soon as we observe a number of things we see that sometimes *paper* conventionally is *cloth*, and vice versa; and animals and plants are seen to merge indistinguishably together. Hence, we obviously need naming factors that will be *more specific* than those names which are actually so vague that they fail quickly in use to stay "definite" and "distinguishable," as we just saw. And what is of more importance, we need to know also the unification of (say) those *four* factors—to know, e. g., *Plants...×Cloth...* (the cotton fabric industry is largely summarized in that formula, for instance). Therefore all the more urgently do we need *more specific* naming factors, that will not lose their definiteness and usefulness in ordinary phenomena at least (e. g., suppose we burn the *cloth*; then, *as* cloth, it is gone, and we would have to skirmish around for some new words before we had got fairly started on a discussion of *cloth*). "Scientific" descriptions are merely those which use those more minute and hence more generally applicable factors, or splittings.

b. But the theories mentioned above suffice to make it obvious that all theories are finally identical. Superficially, the most thoroughly different conventional theories are the atomistic ones and the "continuous" fluid ones. But we have seen definitely that finally in practice they become identical in meaning—and that their inventors, by using everyday logic, usually made them formally almost obviously identical. And similarly, we have just seen, in terms of *That...×This...*, precisely the same ultimate unification of the verbal contrast of "rigidity" and "elasticity," "static" and "dynamic," that we saw in terms of *M(varying with)-L^2T^{-2}* in §§74g, 80i.

c. Those fluid theories may all be said to rest on what is called Bernoulli's principle or theorem ("Ency. Brit.," xiv, 42-3). That theorem is the law of conservation of energy in terms of fluids, and can be expressed and experimentally exhibited in many forms. We may state it in this form:- parts of a moving fluid which have a relatively higher velocity have a relatively lower pressure; and vice versa. (If the fluid is supposed to be "frictionless" that statement is directly positive as a sort of standard unit or One; no fluid is such, and hence internal rotations of all parts, resulting from friction, have actually to be considered in infinite regress as being part of the true "velocity." A vortex whirl is the most uncomplicated of such *actual* fluid flows.) —— Bernoulli's principle may be illustrated by the reactions of water flowing through a pipe containing a contraction, as shown in cross-section in Fig. 95c. Obviously, if a certain volume of water flows through the pipe, filling it continually, the velocity through the contraction is greater. If two small vertical pressure columns be attached as shown, the water will rise higher in the one attached to the part which has the larger cross-sectional area, in which the velocity is slower.

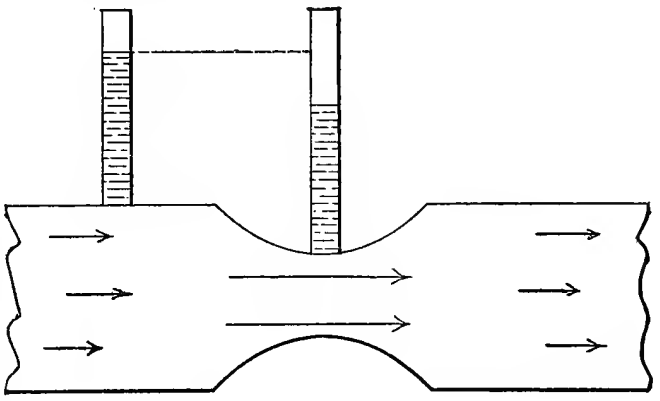


Fig. 95c.

"modest" people, but it is rather obviously objectionable in that it wastes your time, my time, and good paper and ink. —— The only sort of scientific or other caution that is actually logically or rationally or morally permissible to a normal, responsible adult is a statement that we are uncertain as to quantitative measures: if a given measure is of great importance (for the theory of "value" see §168) we should be unusually careful about using it, as it is certain to be inaccurate in some degree. To be "cautious" about a principle or about logic or about a theory, or about any real explanation, or about any general policy or executive policy, is *logically* absurd; for directly by the solution of the One and Many, we either know or do not know what it is; if we do not know, then we can readily *find out* and *decide* by attending to the matter. —— The completing practical remark about that very simple theory is that the greater part of our human personality is *not* intellect or "logic," but emotions (XVII); practically, it takes much training to make the *emotions* stand up firmly on two feet to any such definite principles (Index, "Courage"). Generally speaking, the person who is in practice very sharply, definitely decisive—is a "fine executive"—is often merely a callous, thick-witted brute (e. g., Napoleon, a number of Germans). Only unusually developed men of the executive type, such as Lincoln, F. W. Taylor, Jordan, James H. Foster, Carnegie, have enough emotional strength to be definitely decisive and at the same time be intellectually sensitive and poised and balanced and right. However, the man who publishes a book is responsible for having enough emotional training to make him first *definite*, and then *consistent*, about principles; that is not too much to demand of any man who writes a book, for obviously the writer has *plenty of time* to think and then brace up his emotions, get his courage to the sticking point—*whereas the good executive has but little time* to decide, and hence has to have much greater strength.

A pipe with such a contraction is usually called a Venturi meter. The observed differences in pressure will imply the various velocities, and hence the amount of water flowing.

d. The easiest way to see the ultimately truistic nature of Bernoulli's theorem—to prove it absolutely—is to express, formally at least, the infinite regress in it:- If the contraction approaches a cross-section of zero area, the velocity must continually become greater in order that all the fluid may go through. If the contraction becomes zero, the velocity must be infinite; in such case there is obviously *no* cross-section of fluid which can exert pressure, and hence the pressure is zero. And by expanding the large part of the pipe to infinity, the velocity becomes zero and the pressure becomes indefinite, and sums to infinity (precisely as does the unlimited sum of pressure Reynolds has available to run his universe). —— That is the monistic form of the truism and it is self-evident. The final pluralistic proof is to make a venturi meter and observe it (§35). The mathematical or complete expression of it may be deduced from the last paragraph; for the conventional expression of it, see "Ency. Brit.," xiv, 43, 121; or Bjerknes's mechanics, which are the same as Maxwell's electrical mechanics.

e. It is obvious that Bernoulli's theorem is what we might call the fluid-naming or -aspect of the One and Many. It considers a "continuous" [One] substance in motion [split or the Many]. Obviously, arbitrary parts are conceived as having relative motion, or as being split out of that One; and that verbal contradiction is promptly verbally contradicted by naming a relationship in the 'reverse' way, in the 'direction' of "pressure," so that there is no real contradiction. Or, Bernoulli's theorem is identical with our fundamental scientific law that mass varies with velocity. Bernoulli's form of that law, about two centuries old, is a capsized statement, that pressure decreases with relative velocity, or pressure (and hence density, and hence mass) varies *inversely* with velocity. It always happens that we get a reverse point of view and make language 'go backwards' (become a different form; §104), when we talk of pressure: e. g., grain theory. —— And it is further obvious that all physical theories ultimately use an indefinitely splittable universe, or Being, or One, or ether. And it is again obvious that all of science is rigorously and explicitly unified.

f. But it is obvious that if we try to see all those orthodox theories at once, noting their consistent description or unification in detail for each phenomenon, we are likely to overburden our memories and become confused. The reader who happens not to be familiar with the names in physics is possibly a little confused by the foregoing too numerous points of view, even though they are handled generally. There is no need to try to remember them; if you see only in a rough way that a rigorous unification *is* possible, then you have understood all that is essential, and there will be no difficulty in grasping all that follows. For in the next chapter we use a single, comprehensive machine, a whirl, that can be concretely followed, and that automatically takes in all those conventional points of view. The next chapter is itself dry-as-dust mechanics, with perhaps an occasional bright spot. But we have got to get a language laboriously that way which will stand the strain of giving concrete names to cloth, paper, etc., in all circumstances.

CHAPTER XI. *General whirl mechanics.*

§96. a. Possibly the most important source of confusion or unintelligibility with respect to the various conventional mechanical theories in the last chapter is that people are prone to take them too seriously. They are merely tacit verbal agreements. We are not compelled to use just those agreements, nor to use those of the simpler whirl theory which I am going to outline—although of course if we are to be honest and fit for intercourse with the large majority of our fellow men, and wish to preserve a normal and useful nervous system, we have to adhere to some selected verbal agreement. But some people are inclined to exaggerate one point of view to infinity, and other points of view the opposite way to zero, and thus assert that those other ways are absolutely wrong. Principles or the One are absolute; but ways of splitting the One can not be.

b. And the men who invent scientific theories, just as the men who invent philosophical systems, are often so serious about them that their fanatic insistence upon the sole correctness of their way or verbal trick is liable to mislead others. Consequently, there is in many people's minds a vague belief that there has to be a hard and fast way of describing things. So it becomes desirable that if possible we adopt some easily intelligible way of describing, in which orthodox apparently mutually contradictory theories are all combined into a single directly observable machine which shows that they are not contradictory.

c. Second, although the fact was ignored in the last section, conventional descriptions have a bad habit of using a so-called machine that explicitly occupies only one or two dimensions of space; e. g., the motion of an electron is usually described in two dimensions (because the mathematics for three dimensions are "too hard," as if that would alter facts). There is actually *no* machine in any but *three* dimensions, if we are using everyday language (VIII). So a really intelligible machine, in addition to possessing the reconciling characteristics and obvious consistency required by the last paragraph, and the familiarity and other characteristics required by the last chapter, must explicitly be a 3-dimension one. Then we shall avoid the verbal troubles of trying to talk two languages simultaneously.

d. Third, and perhaps the most important of all, we want a model machine which will *reproduce itself* in higher or lower orders—which will in effect concretely and *experimentally* display the infinite regress. Bjerknes's models would not do it, and he could not finish a unification (§94i). Erwin's wheels, as he describes them, are not, as such, exhibited in any actual machine; he could have rigged a series of gyroscopes which would in general effect have exhibited them. Kelvin some years ago suggested that the universe could be represented by gyroscopes; *and Erwin's is substantially that theory*, although expressed nominally in a quite different form. —— In short, in order to show *concretely* the way to describe static and dynamic, or fundamentally to show *directly any* "transfer of energy" or "change of potential," we need a machine which will *visibly* give birth to smaller or "lower" order duplicates of itself; or which, in collections, will give 'birth' to a single duplicate of itself of a larger or "higher" order.

e. The machine which will concretely meet all those requirements fairly well is a vortex whirl. It has already been stated (§63i) that when our language model is revolved it gives a whirl; hence, all of the theory of language is directly identified with such a machine. These vortex whirls are readily made experimentally with some soap and water and the experimenter's hands (§101); and they can be observed to give birth to different orders, which is something that some machines do not automatically perceptibly do, in the usual senses of those words ("biological" 'machines' do it, of course; XVI). And a whirl obviously has three dimensions; it would take much ingenuity to "drop" one of those

dimensions and talk in a different language about whirls. But the actual proof that vortex whirls have those advantages when used as a mechanical model of the universe is given by the using of that model below.

f. Kelvin also suggested some years ago that whirls would make a good model of the universe. Descartes over two centuries ago tried to use vortices as such a model—which is substantially the same as trying to use whirls. But Kelvin was troubled with the perfect gases and perfect atoms of classic logic, and made his whirls mutually frictionless, and eternal. Naturally they would not "work," as there is not any frictionless part of the universe, unless we agree to reverse language forms. Any actual whirl, as we shall see experimentally, is modified by friction—and thus in the only way possible exhibits the relationship, force, verbally required by any mechanics in our usual language.

g. In the rest of this chapter I give the elementary mechanics or description of whirls themselves, with convenient experimental verification. In subsequent chapters I use those whirls, as being simple and intelligible models of all phenomena, to describe those phenomena. The remainder of this chapter, because it gives details which at first are not obviously useful, will be somewhat tiresome. That can not be practicably avoided. The reader needs to see the general mechanics or relations of the universe summed up succinctly in the model; that is what the model is for. But he may merely casually observe how the summing up is accomplished and not try to remember the details, and thus get through the chapter without painful effort. —— The intelligent reader is aware that it is difficult, by using classic ideas, to determine or express just what are the relationships and reactions, especially the "valuable" ones, between (say) son and father, or a man and his neighbor; or precisely what is democracy, concerning which there are so many conflicting opinions. Our model, by itself splitting or giving birth to sons, and by combining with others like itself to form collections like mankind (or like the solar system—it is all the same except that mankind is much more *perceptibly* quantitatively complicated), exhibits concretely and in the simplest form the complete answers to such problems. I doubt that the solutions of such problems can really be comprehended without the use of such concrete models—which serve to support and connect our memory, that otherwise would fail and leave us in confusion (XVII). In fact, the general solutions of those problems have already in Part One been given verbally, mathematically rigorously, and in terms of L and T. If you completely comprehend the solutions from that form of expression of them, then you waste your time in reading the remainder of the book, which in a concrete and more comprehensible way repeats the solutions.

§97. a. We begin with no assumptions, but with an understanding of the nature of verbal agreements (§22), and a willingness (and ability) to make some and stick to them. Let us say that the universe (or whatever it is that we are talking about: select your own name) is something continuous, which we will arbitrarily split as much as we like, but which universe in that verbally split condition is still, verbally-contradictorily, related together. That is the verbal trick or solution of the One and Many. —— If you do not like those agreements, then you may with equal validity (but with a considerably harder strain on your memory) take Reynolds's or Reeve's opposite ones: occasionally below I point out how you are progressing, if you have chosen thus oppositely. Also, we have tacitly chosen everyday Trinity language; if you do not like that language, then you have an infinite choice of others out of VIII. Regardless of the *way* in which you choose to talk, it will appear that ultimately your meaning is identical with the one expressed in the ordinary way used here.

b. We shall name that continuous something or universe *ether*. We do that merely because it is conventional; if you do not like the name, then call it consciousness, or spirit, or mind, or relationship, or loyalty, or love, or anything else you like; or turn ordinary language upside down, if you like, and say that the continuous substance is non-Being, or non-God, or nothingness, or hate, or non-motion, or Nirvana. It would be precisely as if we agreed to call an *apple* a *balloon*, and vice versa:- it merely verbally happens that a balloon would be what we now usually call an apple. —— If any reader is unable to see that this paragraph is true—that it is actually merely a statement of verbal truisms,—then the only way which remains that can convince him is for him actually to try such substitutions, and see directly what he gets. I have observed that most people idolize words so much that they will not at first believe this paragraph—certainly they can not very readily make their emotions content with such verbal changes for a long while, although intellectually they have no objection (Index, "Ritual"). For my own benefit I have spent considerable time actually making some of the various substitutions suggested: it was profitable to me. Like most other people, I am quite fond of ritual and stereotyped verbal phrases and names—when they are "my own."

c. We shall now consider the ether to be verbally split into parts in order that we may have a positive or Many language. The parts are then really held together or related by a relationship which we may call anything we please. Suppose we conventionally name it *force*: and as the parts are 'held together' let us give it also the more explicit conventional name *cohesion*. (Again, we could say the opposite:- that the parts were *not* held together. That would be identical verbally with Reynolds's "*pressure*," which is the reverse-direction relationship. But obviously the final meaning is identical.) —— Such split-up ether that is held together by cohesion is obviously, as a truism, *viscous*—or is not the mathematicians' frictionless, perfect fluid. The parts of our ether, as a verbal agreement, rub together with some friction. That characteristic of course, in terms of ordinary language, agrees completely with *all* the actual parts of the universe that have ever been observed: nobody ever saw any actually frictionless parts, so it is rather a waste of words to talk about such. The fact of the matter is that Reynolds, e. g., gives his grains *mass*, and hence actually a resistance to their motion (a substantial friction, regardless of what it is called or where mechanically 'located'), which he nominally overcomes by the "force" of pressure. His pressure is then actually a relationship; he merely has not stated explicitly the truisms. The truth is again obvious:- that the "force" which "runs" the universe is truistically merely our name for the relationship of continuity.

d. Suppose we name those parts of the ether *ether cells*, or merely *cells*. As it is an arbitrary procedure to assert parts, obviously we can keep on dividing ad infinitum. *Finally*, an ether cell would be *absolutely* a geometrical point, of no space and time, that formally corresponds perfectly with the One from which we started—and would be Reeve's theory, and substantially Reynolds's. But, we are going to use *positive*, finite, Many or scientific language, and introduce *quantitative* inaccuracy. So we say that the cell is of some small finite size (thus definitely introducing *L and T*—but I shall not go into that again as it would be only a repetition of Chapter III). —— That cell itself is, truistically with the last two sentences or because of the actual infinite regress, *further divisible*; hence it formally has parts which can move relatively to each other, or *is elastic in a vague and*

unexpressed quantitative degree. Regardless of how small we make the cell, there inevitably remains that vagueness as to the *measure* of its elasticity. The real measure is 0 and ∞: it is absolutely a One:—but language disappears if we use that. Hence, the elasticity (or a cell's actual splitting) is pluralistically or scientifically *indeterminate*; in other words, it is absolutely impossible in any finite time to get *any* absolute accuracy in *any* scientific or actual measurement. That vagueness as regards that cell will never disappear, as it is a verbal truism.

e. All other valid mechanical theories or verbal descriptions will have the same inaccuracy or its equivalent. (If we use an *infinite pluralism*, thus starting with fixed cells of exact size, we get a variable, inaccurate One, which obviously amounts to the same inaccuracy.) Both Reynolds and Erwin fail to state that logical point very definitely: they calculate the "size" of their standard small parts, which in our machine are called cells; but both of those calculations finally take for granted that V_1 is fixed and constant (and it is not; §127), which amounts to making the One constant; hence their sizes are merely relative approximations—M_e's, applying to *our average* environment, and really unfixable with respect to a general environment that is a One truistically variable. Also, if later on we say that light is *waves*, then one size of ether cells would fit average measures—be fairly accurate. But if we say, as is equally correct, that light is corpuscular as Newton had it (i. e., is not formally continuous, but is verbally made of small "structures"), then a different sized, smaller cell would be needed for the same degree of quantitative accuracy. In short, any "size" of cell which we determined on would give a certain degree of accuracy—whether close enough to be acceptable or not depending entirely on the fineness of our perceptions, measurements, experiments, standard units. The mathematicians can readily calculate those sizes (they are the ultimate arbitrary *quantitative* bases of harmonic periodicity) from the mathematical theory of unification in IX, and by following Erwin's and Reynolds's methods if they need such guidance. But we do not need such figures in this book, for we can get a better concept of what an ether cell is, and its practically-varying sizes, in this way:- Suppose that our stellar galaxy (i. e., the nebula in which we are, of which the Milky Way is the base; XII) is an atom in some world like this earth, but larger. Then our solar system—which is obviously a variable, elastic affair,—which would be an atom of our galaxy, would be an electron of that larger world. And then, what to us is a pin head would in size serve an inhabitant of that larger world as a pretty accurate ether cell. Similarly, what to us could be a fairly accurate ether cell is a perceptibly variable molar body to an inhabitant of a world inside one of our electrons, and he would have to split it (our cell) up quite a lot, quantitatively, to get a "fundamental" description of it. And so on forever;—that is what an infinite regress actually means. —— From that can be seen the consistency of asserting that there is no such exact thing as an ether cell. It is just an *arbitrary* very small part—*small* to *us*: we are enormously big to some things and enormously little to others.

f. We may also note again that when we say we split the ether into parts, then in ordinary language (because of having introduced L and T) we imply simply as a verbal truism that there is relative "motion" of those cells. (Or, we could use an inverse language such as Reynolds's, in whose theory the grain *plus* its vacuum does not necessarily *as a whole* move; i. e., we could assert a static universe—static *relative to any given* part. But that would, as an obvious truism, and as actually seen in practice in Reynolds's theory, produce the same final meaning as our everyday way of naming "motion.") —— And that is the last verbal agreement needed, and the last time the reader could consistently require a general change in the everyday verbalisms which I have been stating as the ones I am explicitly to use. I have given the reader who does not like everyday commonsense language an "infinite number" of other expressions to select from, and shown explicitly the translation of each into our language, and demonstrated in general that all those languages give the same meaning as the meaning now to be expressed in our commonplace language.

g. If the cells were absolutely distinct, then the relative motion of any two of them (say we take two tangent cells) would obviously require or exhibit either 0 or ∞ force—i. e., relationship. Reynolds's grains are thus distinct, and he fundamentally had to use mathematical trigonometric *fictions* to get any Many measures (e. g., the tangent of 0° is 0; and of 90°, ∞; with "actual" values between). That fiction is the orthodox mathematical error that 0 and ∞ are numbers (§44); I shall not use the direct mathematical avoidance of that fiction here, but express the consistent avoidance or solution directly in terms of parts of the ether. *Strictly* speaking, with such absolutely separate cells (i. e., in explictly infinite pluralism), the size of them (or of grains, or Reeve's masses, or Erwin's particles) would have to be absolutely 0 before we could have a really positive language in which there was a canceling number of formal contradictions (in short, for explicit verbal consistency we *must* assert explicitly an infinite regress). That is a repetition of pars. d and e from a reverse point of view.

h. Then, when I assert that the cells are not distinct or of accurately fixed size, it is obvious that it means that that way of asserting the infinite regress formally requires that the cell be finally divisible into relatively moving zero points. Then, any motion of any point is zero-infinity, or indeterminate, or mystic. Therefore, when we arbitrarily proceed from that One to the agreed-upon Many, we truistically take a time and space assemblage of those points and *arbitrarily* assign a positively named or numbered L *and* T to it (i. e., assign a *finite* size—verbally contradictory to the One): we number or name that L *and* T, or *Energy*, or force, *anything we please.* And the *inaccuracy* of such "*measure*" is merely fundamentally a truism of the fact that *there really is no such thing as an actual measure*, or that the One is ineffable. —— That is of course another repetition of the solution of the One and Many. It sounds odd in that "concrete" form. But it is the explicit general expression of this very simple fact:- If we slide a finger over this paper, there is friction. Parts of the paper enter into depressions in the skin, and vice versa —there being transfer, or "wear," of the paper into the skin, and vice versa. Ultimately, the "friction" is the relationship of absolute continuity. If that is not so, then the motion of the finger over the sheet involves absolute tangential motion, and zero energy is exhibited—or *no phenomenon occurs*,—which glaringly is not so. Hence, with rigorous logic (this is of course another repetition of the One and the Many), the fact is that the finger and paper absolutely merge; or part of the so-called paper is in the so-called skin, and vice versa. —— Now, from that fact, which is so obvious that we customarily take it for granted without expressing it, we get this very simple and intelligible relationship for our ether cells:- the outsides of neighboring ones *are* together, or stick together, or merge together (or negatively expressed, simply have never absolutely split apart), and exhibit friction when there is any relative motion of the two. (Precisely the same thing happens with respect to the parts inside a cell, ad infinitum.) That statement is the

formal expression of *any* "motion." By explicit classic logic obviously it is impossible that there be any motion; Zeno's paradoxes showed that centuries ago, as we saw ("Ency. Brit.," "Zeno"). This paragraph is hence a detailed, concrete, consistent expression in everyday language of *motion.*

i. Therefore, with such moving cells, and with an inner infinite regress of motion in each cell, when we inaccurately speak of a finite relative motion of any two cells another verbal puzzle arises. We may consider the cells each to be like a toy rubber balloon, with the surface covered with sticky glue. The problem is whether the relative motion of two cells consists (1) of stretching the surfaces of the balloons inwards and outwards from their original spherical shapes, while their centers do not move in translation, and the place of the sticking together of the two surfaces does not change; or whether the relative motion consists (2) of the same stretching motion, with the sticking-together places slipping more or less on each other so that the motion is a rotation of the cells as a whole; or whether the motion consists (3) of a translation of the whole original centers of the cells, accompanied by some degree of stretch of the surfaces with (A) fixed sticking, or (B) slipping sticking, or (C) rupture of the sticking. That problem is obviously a verbal quantitative one of some complication. None of those things can happen if the Many cell or part is *exact*; but we need not go again into the solution of the One and Many with respect to each phase of the complication. (The same complication is tacitly buried for Reynolds's grains in the 'vacuum' that surrounds each; for Reeve's points, in the 'distances' between them; for Richards's compressible atoms, either in the "fields" of kinetic theory atoms, or else in the omission of saying *how* anything can be "compressible": and it is tacitly buried in other theories. Obviously, it truistically is inevitable. So I am being *definite* about it here.) —— We merely observe, now that we know how the One and Many works, that the verbal problem of such motion itself takes an infinite regress; the three heads under which I with arbitrary formality stated the "problem" indicate that regress—and that it is a quantitative problem of *where* and *how much.* So the problem above is itself absolutely insoluble *accurately*, and has no essential meaning (i. e., there is no such real problem). Formally, and with rigorous logic, we instantly solve it arbitrarily by saying that we shall roughly have it that the cells have some of each kind of motion:- that specifically with reference to two originally touching cells there is some surface sliding, and then rupture of surface contact; some internal stretch or elasticity, largely stopping when the contact ruptures and translation as a whole (revolution) takes place. To illustrate that:- if we had a roomful of the sticky rubber balloons, with a string tied to one near the center of the room, and pulled hard enough on the string, there would obviously be some perceptible degree of each sort of motion in some balloon or another, and some motion in each balloon. The quantitative theory of those motions is an arbitrary matter, and has no end; it simply is truistically impossible to work it out in complete detail. *But,* we can readily enough get sufficiently close answers by experiment or experience in a particular case and predict such answers.

j. The sum of the last paragraph amounts to saying that there is absolutely no *accurate* decision possible as to whether the motion of the universe *in any given place* is (1) a *vibration* (where the cells stick together, as is substantially the case in Reynolds's theory or in orthodox wave theories), or (2) a *translation* (where the stickiness of two cells ruptures, and the two move apart [finally in closed orbits], or revolve [as is substantially the case in Reeve's theory or in ordinary kinetic theories]). The obvious truth of the matter is that *neither* sort of theory—(1) wave, or fluid, or formally "static," or (2) kinetic, or formally "dynamic"—is accurate. So it is a mere matter of convenience as to which one we shall use in a given case (of how definite or accurate we want to be or need to be in expression), the ultimate truth obviously being that in a finite Many language, some degree of one sort of motion implies some of the other. —— This fact that any phenomenon may be expressed validly, but inaccurately, as either a "vibration," or as a molar "movement," is rather hard to see when expressed in the above general form. It is easy to see when we come to use it in detail.

k. This section completes the general explicit description of an ether cell. That cell exhibits, for each of an indefinite number of points of view, the inherent infinite regress of *any* actual *That* or *This.* The reason this section seems complicated is that I have condensed all of Part One into it, in being explicit as to the solution of all those infinite regresses. Possibly it will be a year or so before the reader can feel comfortable and at ease in the conscious explicit presence of one of those regresses. But now that we have summed all those solutions into the ether cell, we shall no longer be troubled by the explicit or obtrusive presence of a regress. So we are ready to get the summed motions of two or more cells. In short, having split the universe down to the limit, we now start putting those parts together again, and in so doing we describe everything. And immediately on considering a number of cells in motion together we get, truistically and also experimentally, a whirl, which is an easily observed unit structure, that turns out to be mechanically identical with the reactions of a cell itself, and that also serves as the automatic model of everything.

§98. a. The universe is therefore *inaccurately agreed to be* a number of cells. By the theory of commensurability (§50), any certain number of constant cells would fail to make a universe or anything (which statement summarizes the regresses stated in detail in the last section). Therefore, as a truism *all* cells must continually be in motion as an attempt, to speak "logically," to bridge that verbal gap or incommensurability or contradiction. Also, and what is equivalent, no cell of a positive size (and all are agreed to be positive—to have a definite L and T) can ever possibly be in a position [perfectly] symmetrical with any certain cell or cells. Therefore, no two adjacent cells may ever have exactly the same amount of motion or energy. As we have agreed that the size of cells is variable (i. e., they are splittable), we must therefore, in order to have *any* positive language agree that each cell will always be *verbally* the *same body.* To say that is not saying that an ether cell is always the same mass. A cell is always varying in mass (cf. par. h). But a cell is always the same *That* or *This*—is $That_e$ or $This_e$. It is a fixed *verbal* counter or symbol. It is a *positive*, 'verbally surviving' unit of the Many, but in every actual way is varying, inaccurately measurable, and *irrational alone.*

b. Consequently, we must state the relative motions of at least two adjacent cells in order to be rational, The adjacent cells may first be considered as *joining* their sticky skins along a part of the circumference, as shown in cross-section in Fig. 98b. Then, because they cohere and are in different rates of motion, they will (1) *rotate* in the *same* direction, as is shown by the arrows; and (2) one cell will to some degree *revolve* about the center of the other. (In expressing these mechanics I make the usual

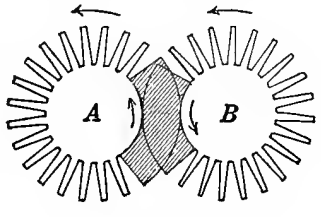


Fig. 98b.

distinction that a body *rotates* when it turns [approximately] around its own center, as in the daily rotation of the earth; and *revolves* when it turns around some other approximate center, as the revolution of the earth about the sun.)

c. We first consider that rotation in the *same* direction (Fig. 98b). If there is any actual *reaction* between the cells A and B, then obviously they must rotate in the same sense, so that the joining portions move oppositely, as shown. That is contrary to Maxwell's vague guess at a mechanical ether. But the essential point is that so far as we have yet gone, those two cells (virtually 3-dimension wheels in this reaction) are formally the total universe; from that point of view their rotation in the same direction is readily proved experimentally:- Suppose A and B were two spur or cog wheels (as partly indicated in Fig. 98b), and that we supported them by their axles (not shown) so that the cog teeth meshed (those pictured are engineering monstrosities, of course). Then, the only general way in which we could make the *two react* would be to pull A quickly down (say) for some distance (and B upwards, if we liked); the teeth would of course shortly unmesh, and the wheels would rotate in the same sense, in the direction shown in Fig. 98b. If instead of the 'sticky' cells, we had cells that had very flexible rubber cog teeth, and meshed them loosely together, we would get the same reaction somewhat more clearly, the teeth reacting, and bending out of mesh. —— Clearly, if the two wheels rotate in the *opposite* directions with teeth in mesh, *no* reaction of *just* the two wheels (i. e., of the two considered as a standard or whole One) occurs, except in so far as the *teeth themselves* have friction (which is a lower order reaction). If *that friction* be free to exhibit itself in a *reaction* involving perceptible motion of the whole wheels it obviously will *push* the wheels *apart*—so that the two, *at the point of contact* move in *opposite* directions, which obviously amounts to identically the same reaction already described for *rotation* (note the small arrows at point of contact in the figure).

d. Before we explicitly take up the revolution of (say) B about the center of A, we need to consider in general the motion of a collection of cells in the total universe of cells. Obviously, as already seen in §94d, if a collection of cells moves, its place has to be taken by another collection.[98d] In order to avoid infinities and zeros (to avoid lapsing into One language), that replacement would obviously require some short time and be accompanied by some slight stretching of cells (in infinite regress as indicated in footnote). (That is obviously what happens, as also shown by direct experiment; e. g., if a puff of smoke be blown into the air, time is required for the reactions.) But obviously that motion *finally* is in a closed path. The part that first moves takes the place of some other part; and that, of another part; and so on until the last part that moves takes the place of the first part that moved. (Obviously, because there is some elasticity or vibration, in actuality that motion involves *in some degree* every bit of the universe; that is the infinite regress, or it is the way the One and Many *absolutely reconciles* itself in this description. We simply *quantitatively* ignore the vibrations that are extremely slight: we can't yet in any way *perceive* such vibrations that are much beyond X-rays in smallness—unless the yet unmeasured reactions in telepathy, "personal magnetism," etc., are such). —— Hence, all motion in the universe is *finally revolution.* If we speak of "translation" (or "vibration," meaning *strictly* back and forth translation), then that is but a *partial* statement of the total motion which finally takes place.

e. Therefore, because the motion of A and B is necessarily asymmetrical, one cell must necessarily finally *revolve* about the other. For the reaction of the sticking surfaces (or of the elastic cogs) accounts for or provides for only equal or symmetrical motion in each wheel. It is therefore again seen (and again it is directly truistic with language agreements), that there can be no accurate solution of the motion of two bodies (§83). For there is no possible way of determining just how much asymmetrical the motion is; that is finally dependent upon relative sizes, etc., as given in §97i. So it does not in the least "simplify" anything to use a machine of only two cells. Hence we shall at once consider more cells and get explicit whirl mechanics. The foregoing is the rough, general logic or mechanics of whirls.

f. For the foregoing, in addition to omitting the other cells that actually existed, also has been tacitly dropping a dimension of space. If we consider that A and B in Fig. 98b are actually 3-dimension approximate spheres, then the actual reaction, instead of taking place in a plane, as the figure tacitly indicates, takes place in the 3-dimension space in which the 'surfaces' stick together, or the flexible cogs intermesh (the 'cogs' on such spheres could be small radial pins). And in that actual case, obviously there is nothing to determine positively the *direction* in 3-dimension space in which they rotate. In terms of technical physics they have six degrees of freedom (i. e., three dimensions in two directions each); that substantially makes six specific vaguenesses. And in our actual model (i. e., the whirl we are going to use) we are going to eliminate all such vaguenesses. They will still be there of course *in reference to measurings*, or when using the measuring member. But we are not using that member now, but are using *That...*$\times$*This...* which is to have concrete, direct experimental positiveness.

g. Consequently, we observe that actually A and B are surrounded by other touching cells, and that in each case of two mutually reacting cells the motion is asymmetrical or unbalanced. The motion or reactions for two cells was-were seen to be *as a whole* balanced when we were considering it in a 2-dimension plane, by *all* the 'closed' or universal motion there is—namely, a rotation and a complete revolution. We may note that that leaves an unbalance *in the third dimension*; i. e., on *each* side of A and B in the direction perpendicular to the plane of the paper there is an unbalance. That unbalance has to be totally or ultimately compensated precisely as we ultimately balanced A and B in just the plane of Fig. 98b. I. e., there can not be either perfect rotation or perfect translatory revolution of A and B in the third dimension: there must be, for finite Many or pluralistic language, an infinite regress, which gives a combination (in some quantative degree) of such rotation and revolution *and* of elastic internal "reaction" (i. e. *inner* rotation and revolution), of adjacent cells (cf. par. d and §97j).

h. And therefore, if we begin by considering that there are numerous cells in the plane of the paper (Fig. 98b), the reaction of rotation and revolution of all the cells will sum up as being of precisely the same nature as for the two, keeping in mind that there is some elastic change in the size of the cells. That is a verbal truism with 'mass varies with velocity.' For obviously, that elastic change is a change

[98d] If the cells are elastic enough, the cells that 'move' may merely "condense," and adjacent cells "dilate," so that there is no change in the relative order or arrangement of *cells.* That, *relative* to the cells mentioned, would be a *formally* absolute "vibration." But obviously, the *size* of the "elastic" yield made it result that there were merely "vibrations," and the 'motion' I am describing in the text would then take place relative to 'parts of cells, instead of relative to whole cells. Hence, the text which I give is always applicable if we take parts small enough. Compare also §97j. Neither "vibration," nor the 'motion' I describe, is *perfect*; to avoid lapsing into One language, when those cells move *some "elasticity" must be exhibited in order to make the motion use a finite time interval.*

in mass, and the rotation and revolution (considered apart from the *inner* change or elasticity) is velocity. It is similarly obviously truistic with Bernoulli's theorem.

i. Then, to *complete* or finally balance that reaction in the plane of the paper (Fig. 98b), the sideways unbalance will have to be taken up in precisely the same way by cells on the sides (i. e., by cells up and down from the plane of the paper). By Bernoulli's principle the greater the local unbalances or the higher the pressure, the slower the velocities. Consequently, by that, *just in the immediate vicinity* of the plane of the paper there forms a tube—"eddy"—of rotating and revolving cells, with any cross-section of it that is *approximately* parallel to the plane of the paper equivalent in motion to the motion in the plane as described in the last paragraph. And that now *partially* described balancing of motion, or definite statement of equal action and reaction, in three dimensions is identical with the "tubes of force" used by Faraday, Maxwell, and finally with practically completing additions by Thomson. Also, it is substantially identical with what Erwin calls "ether flow" from the center of his wheels. In various formulations of physics that tube (just a *short portion* of which I have so far described) is called fluxes, stresses, strains, magnetic lines, displacements (electric and otherwise), currents, distortions (of various sorts), centers of gyration, etc. Consequently, the concrete reactions I am stating here may be compared with those conventional mathematical ways. The difficulty with the conventional ways is that they usually tacitly consider that tube as being *exactly* perpendicular to the plane of the paper, and hence as extending indefinitely up and down (I have asserted or shown no such tube: see next paragraph); consequently, conventional ways usually get "lost" right there, in that 0 and ∞—as those "unending" tubes are obviously unintelligible, and agree with no machine or finite thing, being really a One.

j. As we have here carefully carried along a verbal balance between the zero-infinity One and the arbitrary finite Many, we may now at once see precisely how to complete that tube and make it actually practically balance, and at the same time show the *explicit* completion of all conventional ideas of tubes of force, etc. We have already seen repeatedly that the only possible way—the truistic way—of completely and wholly balancing those unbalances is to make a *closed* path. Ultimately, the only way of obtaining that closed path with one tube is to consider it bent around into a ring (i. e., it was only *approximately* perpendicular to the paper in the last paragraph, in order that the cells in the plane of the paper should balance), closing on itself, thus forming *roughly* an anchor ring or tore or doughnut, or a vortex whirl or whirl (§68hi)—or a *somewhat* fully formed and enduring eddy, of which a whirlpool is one not very obvious example. Actual finite parts of the universe then, in such a structure, are in *rough* equilibrium (i. e., absolutely complete balancing is obtained *only* by considering some elastic motion of *every* part of the universe in infinite regress—as we have already seen repeatedly; e. g., in §86). That whirl is our unit structure, or symbolic machine, or $This_e$. Verbally, its formation is the expression of truisms; for a concrete tube has to *end* somewhere; otherwise we abandon scientific language and revert to the One—which, although quite correct if acknowledged, is no longer the science we agreed to make. Faraday substantially made his tubes close on themselves; but Maxwell lost the idea. Thomson makes his tubes end in "positive" electrons; but positive electrons are nothing more that standard Ones (i. e., they are mere logical verbal unifications of electrons); hence Thomson implies that ultimately all whirls are themselves united, which means that no whirl is a perfectly closed or balanced structure. —— It will be noted that I have said above that our closed whirl was in rough equilibrium. This whole Part Two is required to show that (i. e., the whirl, not being in *complete* equilibrium, changes itself in various ways into other structures, and thus transfers energy, or displays all phenomena). But this much of this chapter shows the general completion of the electron theory. We see the details as we proceed.

k. Instead of having the tube 'close on itself' (as in the last paragraph, thus forming a whirl) in order to obtain a *fair* dynamic equilibrium for a given collection of cells, it would have been possible (as the only other *verbal* alternative) to have the cells all take up mutual motions more or less immediately or directly closing on themselves (in the sense that a *rotation* may be said to be a *self*-closed *revolution*), thus forming a more or less spherical or spheroidal body or collection of cells. But we note at once that if the 'tube' were of sufficient diameter, so that when it closed on itself no "hole" was left in the ring, then the so-called 'ring' or whirl itself would quantitatively be more or less a sphere. (I. e., suppose we made a doughnut out of a tube or roll of dough—instead of cutting out a hole as is more usual in hand making. If we made the rolls relatively short, then when we bent the two ends around to join them together, no hole would be left, and the dough would squeeze into more or less a sphere.) Consequently, that spherical form of dynamic equilibrium is merely a special case of a whirl (a *quantitative* case, in which case conditions are pretty steady, or potentials are comparatively low). We shall see, e. g., that the earth is a whirl (XII). On the other hand, the closed tube—the filament of the whirl—could have any degree of tenuity compared with the size of the hole. If the tenuity went into the limit of becoming a *line* closed in more or less of a circle, with a hole therefore of a size "infinitely" greater than that *line's* 'diameter' or size, then our language would obviously reverse—the One and the Many formally exchanging places, giving explicitly an infinite pluralism. In the precisely analogous case of where the hole or radius becomes zero (*if* we were to consider it explicitly) our language also reverses. Therefore, as we shall see (XII), the spherical form of whirl is a 'reversal' of the ring form. In *practice* we do not let the logic or language itself change, but our *point of view*—or statement of *L*,—in lieu of such logical change, changes from in to out, or 'reverses'; or, from the same point of view the language 'goes backwards' mechanically. Or, what is practically important, the sphere is (to use customary terms) static (e. g., we say the "solid," "steady" earth); and the whirl which is not a sphere is dynamic (e. g., the magnetic "field" of the earth; or the winds that blow over the earth).

l. It is hence obviously a truism that when we considered our rather spherical ether cells as being variable, or elastic, we thus considered them as being whirls also—very small whirls, the definite *motions of translation* of whose inner parts were so short that we quantitatively neglect them. In brief, our valid logic appears perfectly circular—and valid because it consistently includes the universe. Therefore, as some more obvious truisms, any actual body whatever in the universe may be considered a whirl; or any part of any body or of the whole universe is a whirl; or the universe itself is a whirl. I shall explicitly show all that in direct, concretely verifiable detail as we proceed. So in a whirl we have a machine model, immediately applicable to anything. In §101 I shall describe some experimental whirls which you can make for yourself in a minute or so; then you can substitute that visible affair as being the directly usable summation of these verbal truisms which constitute the mechanics of a whirl—for these truisms are rather tiresome and hard to remember in their verbal form.

m. As we saw, because no cell can, by the theory of incommensurables, possibly be quantitatively accurate, therefore no finite collection can be accurate or symmetrical, or in absolute equilibrium. Hence, a finite or actual whirl is never in absolute equilibrium with its environment—or what amounts to the same thing, the whirl is not perfectly closed, does not have a definite surface, etc. In brief, the whirl, as our actual structure, is not a perfect or an exact structure. Therefore, if we conceive a geometrical line in the whirl which always passes from one cell to another at a point where the pressure in its constant change is instantaneously zero or balanced, then that line obviously would be continuous; the point mentioned would always be the instantaneous point of rupture; the line would always be changing its location; it would be the conventional path of least action (explicitly the path of zero action, which is the limit of *least*); it finally at some point would leave the given whirl to join similarly continuously with the rest of the universe, and would reenter the given whirl at the point where it was beginning to join another (the cell-pressure being there infinity, which, as we shall implicitly see in the rest of this chapter, is the same as the zero-pressure from the opposite point of view), after having passed through all the points of all the other cells in the universe simultaneously (as strictly by the *infinite* regress, each *point* is always rupturing from one point and joining another). Hence that line, which is analogous to the conventional stream line, would be infinitely long, and formally would outline the total structure of the universe. The line would in every respect be zero and infinity, so that a geometrical point (zero mass or zero "material") moving in it at infinite speed would obviously truistically *be* the universe. In brief, all "materiality" absolutely disappears from the universe whenever we give *explicit* and *rigorous* description (and the description just given is quite orthodox, being the ordinary principle of least action stated in an obviously truistic form). We see that the so-called whirl or "matter" I am talking about is a mere *form*, a verbal trick, which *outlines* the absolutely inexpressible finally real universe, which universe or God is the line of least or absolutely zero action. We land in Nirvana, here and now, by that particular view point (we could shift to *infinite* God by emphasizing that the line reentered each cell or point at the point it was joining another); and we did it by being persistently and really concrete—by really sticking to Newton's third law, which the materialists fancy they accept. Only by being metaphysical and vague and inconsistent like conventional theologians and materialists is it possible to be materialistic and "worldly." —— The reader need not take this paragraph too seriously. It is ultimate truth; but as we see in ethics (§§166, 162), ultimate truth is a dangerous thing to dwell upon explicitly without previous training: just a touch too much of it for an unprepared man, and he goes insane, as, e. g., did Newton temporarily and Swedenborg rather persistently. So if you do not grasp this paragraph for a month or two it is merely nature automatically and properly protecting your brain from too sudden a load. I abruptly described the total universe or God in sharply precise physical terms. If I had at the same time definitely shown that the sum was also a person, if nature had not sufficiently protected you, you would have become "God-intoxicated," or in undue measure have had what the theologians usually call a rebirth or salvation (cf. §153).

n. Without being so ultimate as in the last paragraph, we may observe that because the whirl is not exactly in equilibrium, there are truistically variations from a perfect geometrical tore, which we may note from three important points of view:- (1) The 'surface' of the ring is not a sharp geometrical surface, but is a variable, 3-dimension "zone" of high velocity and relatively low pressure, which "shades off" with lower velocities in *both* directions away from that 'surface' (in the direction of the perpendicular or normal on both sides of the 'surface'). I. e., there is rotational and revolving motion "*outside*" the ring or closed tube, as well as inside it. The ether cells outside with that shading-off velocity constitute what I shall call the *field*. In Fig. 98n two views of a whirl are shown—in cross-section above, and

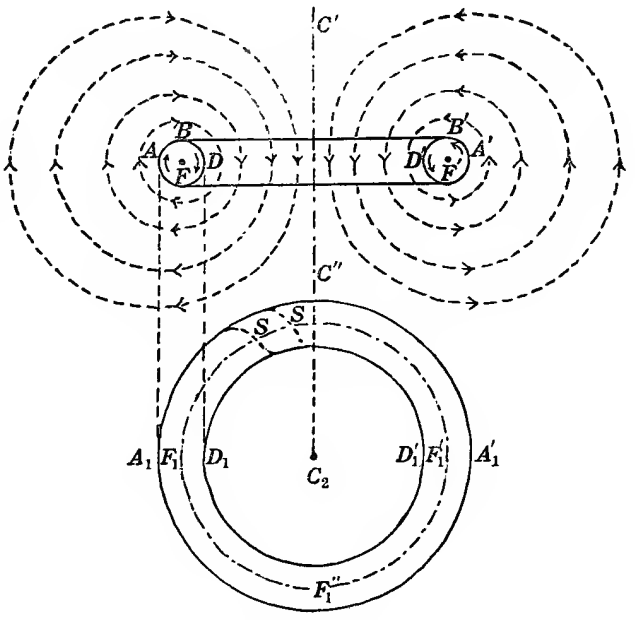


Fig. 98n.

in plan below. The closed dotted lines about the tube (which tube is shown in cross-section at ABD and A′B′D′) show the field. (The field is not drawn in the plan view—only the ring.) I shall call the ring or tube the *filament* of the whirl. The filament is shown in full lines in the figure —the plan or doughnut shape being below. The *approximate* or instantaneous center about which the cells of the filament revolve is shown in the cross-section part of the figure by the centers F and F′ of the filament, and in plan by the closed line $F_1F_1'F_1''$. I shall call it the *filiar axis*. The line approximately perpendicular to the plane of the filiar axis, and through its approximate center (shown at C′C″ in elevation, and at C_2 in plan) will be called the *whirl axis* or *main axis*, or simply *axis*. The field *and* the filament is the *whirl*. The 3-dimension surface or zone (ABD, A′B′D′, A_1D_1, $A_1'D_1'$) between the filament and the field I shall call the *difference surface*, or briefly *surface* (when I mean "geometrical surface" in this book, I use that explicit phrase, unless the context clearly implies it). There is also, in the same way, an indefinite 3-dimension boundary of surface on the *outside* of the *field*—'between' the field of one whirl and the field of the adjacent one. I shall call that the *field difference surface*, or briefly the *field surface*. We see more such details below.

o. The second important view to be taken of the result of the asymmetry of the filament is that the cells truistically do not revolve (*and* rotate) in a plane that is normal to the filiar axis; i. e., there is no definite, sharp, exact revolution of the cross-sections ABD, etc., about F, etc., in the plane of the paper as shown by the little arrows. For the 'sideways' pressure is not steady. Hence, there is truistically a sideways (i. e., in the direction of the filiar axis) component of motion, so that as a general sum for the whole filament the filament effectually *rotates* about the main axis, and a cell

in the difference surface thus travels in a *spiral* (as at S, S)—in a line which when projected on the filiar axis in any whirl always makes with it an angle different from 0° and 90°. (Possibly a more correct technical name for that path is *helical*, or screw thread. However, it is not perfectly helical and not perfectly spiral, but a variable path between the two as limits.) Obviously, that spiral motion, *relative* to anything *outside* the filament (to its field, e. g.), may as extreme limiting views be either (1) called a rotation of the filament about the main axis, or (2) called a relatively fixed filament with a spiraling surface (like a helical spring). And those two points of view, when taken to the extreme One limit (to 0, or ∞), are analogous to the dynamic and static views in par. h or in §97j. So we again avoid both verbal mysticisms by asserting that the motion never becomes *perfectly* rotational (for in that case *no* connection could be had with anything outside the filament, which is a self-contradiction; or it is Kelvin's frictionless whirl), and never becomes perfectly spiral (for the same truism). We say that the motion is some of each, and the cells then are consistently of finite size. —— Therefore, now that we have preserved actual finite sizes, without running off into 0 - ∞ mysticism, we get an important mechanical reaction—the completing or ultimate reaction—or the concrete truistic expression of what transfer of energy *is*, of what a *phenomenon* is:- For obviously, with cells of a *finite* size, whenever the angle of the spirals approaches close to 0° or 90° (*how close* depends upon the *size* of the cells), then at that surface locality where it happens, obviously a cell or cells would truistically *leave*, or *enter*, the filament, and the filament thus would partly "wear out" or decrease, or "grow." As orthodox science so often omits that point it is desirable to consider it in detail for a few paragraphs. In the next one I emphasize the point by substantially repeating it in a different form.

p. What we *must* say, as a truism of the positive pluralistic language we are by agreement using (and which is also definitely proved by concrete, verifiable experimental fact in §§101-2), is that if the spirals S, S in Fig. 98n make an angle of 0° (or 180°) with the filiar axis $F_1F_1'F_1''$ (become parallel to it), so that the motion is pure rotation of the filament about the main axis, then obviously there is no reaction, or there is zero force, holding the cell in the filament. Because the cell is of some finite size, therefore it truistically *leaves* the filament and joins the field before that absolute 0° or 180° could occur. Similarly, if the spirals at any spot on the surface approach 90° (or 270°) the local pull on the cells outside approaches infinity, and as they are of finite size, before any actual 90° is reached, one or more cells are pulled into the filament. —— Or, by taking the opposite point of view, the *expression* of all that can be reversed, giving identically the same result. The simple verbal fact is that such 0 and ∞ functions are indeterminate, and are not applicable to finite bodies and can not occur with respect to them. Orthodox science frequently uses such 0 - ∞ forms. When it does it obviously is religion—and is wrong if it professes to be science. As a matter of fact, orthodox science tacitly uses valid logic or commonsense, and asserts the actual or correct answer; for it sees the answer also in the form of experiments, similar to those I shall give. But I am being *explicitly* consistent here—putting commonsense into words, —and as an immediate consequence we have seen already the total explanation of what "growth" is, and it turns out to be identical with *any* actual "transfer" of energy, or any phenomenon. A few rabidly agnostic scientists and theologians hold that the explanation of growth is "impossible." Truistically it would be if pseudo-science kept on dualistically splitting the universe into absolute parts: for such parts then obviously can't formally get together or grow. But we now see that growth, *in expression* is merely ultimately an inevitable truism of our primary agreement arbitrarily to split things into parts. In short, religiously, or from the point of view of the total universe, everything is conserved (that is the explicit statement of the general religious law of the conservation of energy); taking the verbally opposite point of view of the universe as being arbitrarily split into parts, then the identical law (expressed pluralistically in formally opposite terms) is that always each part *changes*—either grows or decreases (*which* it does, depends wholly upon our point of view; i. e., there is no *absolute* evolution or progress *up* or *down*—for *up* and *down* are purely relative or Many; Index, "Direction"). That law of "growth" is hence obviously simply the law, mass varies with velocity. For obviously, here we have concretely given a mass or body (given a cell) a velocity, and we find the resulting structure explicitly growing—and doing it truistically: we have not even made any experimental whirls yet to see it happen. We shall also see (§146) that the same double aspect of the growth of the filament (i. e., "increase" and "decrease") is also fundamentally what we call sex. All of this is just as explicitly biology and sociology as it is physics and chemistry. As a matter of fact, as soon as we get these elementary mechanics summed up into whirls, I am going to use those whirls directly and in some detail to state astronomy (XII), as that subject exhibits perhaps better and more simply than others the familiar principles of biology, ethics, chemistry, etc.

q. Another point of view or way of stating the last two paragraphs is quite useful in giving an understanding of things in general:- When the asymmetry of the filament is considered as truistically giving a spiral surface-motion, it obviously is a part of the same truism that the spiral motion exists in order to balance the filament with the field outside; and that therefore a complete understanding of the truism requires explicit expression of the motion of the cells in the field. Because that spiral exists as a means of balancing sideways asymmetries, it truistically follows that the reaction of the field cells is a rotation *and* revolution (as before, neither perfect or 0° or 90°) of them sideways—on one side or the other depending on whether the unbalance is due to a growing filament or a decreasing one. That is precisely the same sort of reaction we have already seen in pars. h and i. Therefore, the cells in the *field* move in a spiral, the projections of which on the spirals of the filament cross at some angle between 0° and 90°, but never *at* 0° or 90°. When the angles between various field spirals and filament spirals get rather close to those One limiting angles, then, as before and depending on the size we are taking the cells to be, the geometrical paths of a spiraling cell in the field and a spiraling cell in the filament absolutely *join*, making a *rounding* turn of *about* 90°—not exactly so, nor a perfectly sharp turn,—and the cell in that path leaves, or joins, the filament. I. e., if we look perpendicularly down on the path of a cell C, then it has a path represented by one of the two arrows in Fig. 98q, with a rounding turn of about 90°. The elbow in the arrow is in the difference surface—the locus of all such elbows *is* the difference surface. —— That filament surface is identical in kind with the surface of the possible spherical form of a whirl. That of course directly follows from this paragraph, by noting that the motion of the *field* difference surface, relative to the field

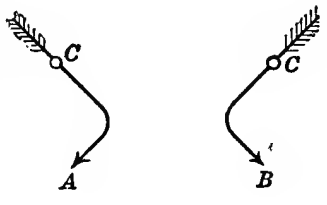


Fig. 98q.

of an adjacent whirl, is mechanically identically the same as the filament surface. And it further follows that if the filament is growing, the cell moves into it on one path (say A in the figure); and when the filament is decreasing, the cell moves on a relatively opposite or reversed path B.

r. It is obvious from the last paragraph that again we have the distinction between static and dynamic. Everything in the universe, by our verbal agreements, is moving. Hence, if we are in the field say of a large whirl, moving along with it, we can arbitrarily consider it static, just as a fish in a muddy stream would not readily notice its "steady" motion (the fish is of finite size; hence in principle he could always detect the motion of the stream by reference to his nervous system, as no finite portion of the stream can have mutually steady velocities of its parts—but in practice, the fish would need some delicate tools to improve his nerves). Then if we undertake to refer to the filament (or to act with it in any way), the surface motion of it tends to approach towards taking a path at 90° to our 'static' motion. So we speak of the filament as 'dynamic,' or as exhibiting energy, and *formally* we must introduce the other two dimensions of space (the verbal inverse square law) in order to assert that motion in a plane at *about* 90°. —— That is now concretely obvious; for in our "static" environment we tacitly assume equilibrium, or that we are in a "center of reference," and hence we *must* for formal consistency assert the *two* balancing L's in going into a different structure. Also, it is obvious (or possibly not readily so just yet), that we could recognize or perceive a filament *only* when it was growing [or decreasing] a little, relative to the filaments in the biological structures of our sense organs. That criterion occurs at V_1 (XIII). All this is "concretely" precisely what we saw "theoretically" in §80.

s. It also appears that because there is universal asymmetry, or universal growth-or-decrease (i. e., change), *all* filaments and fields as a truism are *changing*. I. e., even if we assert that we are in a "static" environment, the actual pluralistic fact is that by measurements which are accurate to within the size of cells, there is measurable motion. So there is no *positive* static environment—or in a similar sense no accurate *wholly* dynamic one. A perfect "static," or "dynamic," one is monistic. Or, in the terms we are now using, all *That*'s and *This*'s are explicitly *That...*'s and *This...*'s. Also, this truism is identical with what we saw in §83g:- that all naming coefficients are infinitely regressive. And so on—in repeated proof of no exact science.

t. I have been speaking above as if there were a number of paths of cells in and out of filaments (*and* implicitly, of fields of adjacent whirls). Obviously, at any given instant the chance that there is more than one path at *exactly* the same phase would be one to infinity. Consequently, and also in extension of the same truism, there is one continuous geometrical line in which *all* the cells must move. That is simply a definite verbal proof of par. m. Beyond the fact that it shows absolute unification, I do not use it.

u. (3) We may now look at the asymmetry of any whirl from the third point of view mentioned in par. n. This point of view is what might be called a structural or concrete summing of the second point of view (beginning in par. o):-

v. In a fairly steady whirl there is, as a truism, but slight change at the difference surface. But when there is considerable asymmetry ("disturbed conditions," considerable difference in "potential," etc.), obviously as another truism, there is a tendency for a number of cells to pass into (or out of) the filament more or less together (never two accurately together, or simultaneously, of course). We shall say that a number of cells come *out of* a filament more or less together, observing concretely and generally what happens :-

w. In Fig. 98w the large rough circle represents a cross-section of a fairly balanced filament. If it is much out of balance dynamically, as we now shall consider it to become, we shall have a number of cells bulging out into the part

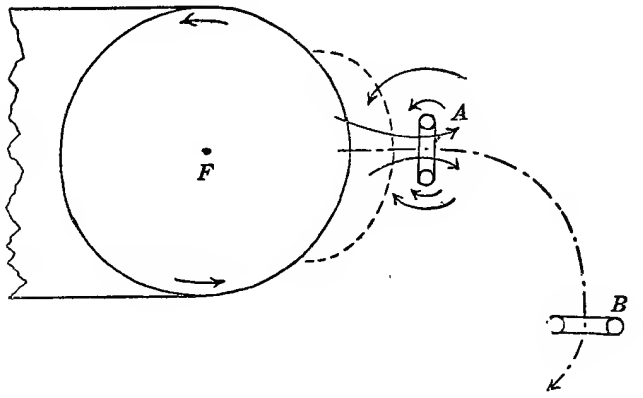


Fig. 98w.

shown dotted. By Bernoulli's principle, the part of the bulge farthest out will have the greatest velocity. Therefore the farthest cell will leave the filament, and others around it will in turn leave until equilibrium is practically restored. They all come in contact with slower cells in the field, and hence curl over and around as shown by the arrows just in and outside the bulge, and thus form a new, small whirl, in somewhat the relative size and position shown at A (the variations from that size, etc., are great, depending on conditions; §§101-2). The new whirl moves off (see next paragraph) to the right, and its environment being asymmetrical with respect to it (usually markedly so, for reasons that appear from time to time), it turns up *or* down (depending for the direction in which it turns upon relative values of velocities) and thus tends to take up a *revolution about the filiar axis* F of the large whirl (subject to taking up also the spiral motion of the main field, as we shall see). The new whirl is shown moving around down, through the position B.

x. A whirl as a whole will partly have a motion of translation (more precisely:- of variable revolution about some relatively distant point), and partly of rotation about its own main axis (more precisely:- of spiral or varying rotation). That is obviously a truism with Bernoulli's principle. Or, *the spirals on the outside of the fields can be considered as effectually a screw thread*, and the whirl will screw itself through its environment, which then acts as a more or less fixed nut. Or, its motion is due to precisely the same principles as were set forth in par. b, relative to two cells, A and B. In short, a whirl moves by the same principles as a cell—another circular checking up of the consistency of our argument or mechanics. Also, we have before seen that a cell will go in or out of a filament (and also, in or out of a field, across the field surface). Here, we definitely have a whirl acting as a cell acts. So we see again, as we saw in par. l, that except for unessential L and T, a whirl is identical with a cell.

y. This small whirl, to which the filament gave birth, is obviously a 'dynamic' body, in that it moves off while the filament as a whole is a "center" or is static. As we saw, orthodox physics does not explicitly recognize any bodies as giving birth to smaller ones (or vice versa)—although all men, e. g., are born. Such physics usually calls those things which are given off "vibrations" or "waves"; yet, as we shall see, electrons (and radioactivity) are tacitly by orthodox physics the birth of such small whirls. And so far as that is concerned, precisely the same idea is definitely contained even

in the old Maxwell physics:- in such physics *God* gave birth to the smaller things—"created" them, in Maxwell's own technical speech. So I am not proposing any novelty; I am here merely being a little more definite as to the *immediate* parents, while also agreeing that as a sum total God or the universe gave birth to all things—and vice versa.

§99. a. The last section gives the general total of all mechanics, and is as such the concrete summary of all pluralistic statement. It is much condensed. But I find that it is much more intelligible that way. Those who have the need or the interest to expand it in detail will have no particular difficulty (except in remembering the details when they become numerous) in expanding it to volumes. I have myself on occasions expanded it to a volume or so. The worst difficulty about those mechanics is to condense them into sufficiently brief expression to be comprehended as a whole readily (so that the trees will not hide the forest), which at the same time permits useful detail to be visible. The last section is a reduction to about 6000 words of a picture or description of the universe in all its infinite variety—undertaking to make the completely unified beauty of the universe intelligibly explicit, and at the same time to make the infinite details and extent of that beauty also explicit enough to be intelligible or perceptible. It is thus an effort to accomplish in explicit completeness what all literature undertakes to accomplish in more or less completeness. I. e., any writing or verbal communication is formally an explicit (or *implied*—as in "nonsense" books like "Alice in Wonderland") statement of the solution of the One and Many—an analysis into parts, which are then synthesized into a complete meaning (and most writers do not take the whole One, but imply it by using a standard One). E. g., the usual modern love story names force *love*, and proceeds to make one couple of people, or several couples, One, or vice versa —with positive mention of such *This*'s and *That*'s as the writer thinks will best make explicitly comprehensible to the reader the One and the Many. The Bible undertakes to do that with respect to the universe. But the author of the love story and the compilers of the Bible failed usually to be very vividly conscious of what they were about. I was quite conscious of what I was trying to do. To those people for whom the last section is comfortably and applicably intelligible, it is "literature"; to those for whom it its not thus successful, it is not literature (success of course includes perceptible stirring of the emotions—'moving' the reader to *do* something *right*, indicated by my phrase 'applicably intelligible'; cf. XVII). If the last section is successful to a majority of readers, then by conventional measures it is literature (§171k). Then, as it is explicitly completely extensive, "greater" literature than that section would *in general* possess (1) more meaningfulness and forcefulness (i. e., more comfortable and more applicable or emotion-stirring intelligibility) in an equal number of words (with the subject remaining equally complete); or (2) equal meaning in fewer words; or (3) both. But, as the estimate of the relative measures of literature obviously thus depends upon the perceptions of the readers, such estimates will change as the readers change, and a direct comparison of literature requires a preliminary comparison of the readers who estimate it. —— That digression as to the measures of literature will, by introducing an odd point of view, probably permit the reader to see just what the last section really means. The reader might try for himself to condense the Bible, Shakespeare, and all the novels and science he has read, to 6000 words intelligible to others, and see how he comes out. As a matter of fact, I did not expect to be successful at it, so I have added the rest of the book to it. —— A volume on the theory of literary construction (i. e., on "making" literature, or synthesis) and criticism (i. e., analysis) is definitely implied by this paragraph.

b. Judged by ordinary standards, the chief omission in the last section is that I have failed to indicate in which *direction* any given motion took place. E. g., I said that the whirl or cell would *move*, but usually I did not show or assert in which direction it would move—whether up or down, left or right, etc. Obviously, the actual direction of such motion will always depend upon the relative values of the asymmetries—which is a truism. Clearly, the motion can always be in either direction; i. e., this machine we have arbitrarily invented is reversible. (It is not *perfectly* reversible, as truistically the asymmetries or measures will always be different if it runs in the opposite direction; but it is always logically or qualitatively perfectly reversible, and hence the universe as a whole is perfectly reversible in measure as well as form —which is the same as saying that L and T do not apply to the One.) As an explicit example of my omission of directions, when I said (§98x) a whirl would move, or screw itself along, between adjacent whirls, I omitted all remarks about those others whirls even having directions of motion. Obviously, the others too would have motions, so that the whirl mentioned, in its somewhat corkscrew motion in the general direction of its main axis (cf. path of solar system, Fig. 107e) has a *direction* that depends on those other motions. I propose usually to omit naming such environmental directions; for if I did name them, I obviously somewhat obligate myself to the ad infinitum task of naming the relative directions of all motions in the universe. I could not, while trying to set forth the principles, maintain such a grasp of details: no reader would stand being bored by such detail, even if a publisher would print it [and since I wrote that about 18 publishers have in effect assured me that readers are not interested in even the essentials of the universe or all things; but I think they overestimate the prevalence of the provincial or New York weakness known variously as pep, punch, brevity and speed in the actual sense of shallowness, that is shown in get-rich-quick and living-your-own-life-and-to-hell-with-others delusions]. And worst of all, there is no general agreement as to *how* directions shall be named from any given place, so that I would also be involved in a complete revision and unification of *all* scientific standards (as all of them finally depend upon L or 'direction'—T being implied), which is rather another story. Or to put it in terms of the last chapter (also, cf. §§58g, 101i, 134d, 135c, 149, etc.), if I name directions, thus somewhat obligating myself to state environmental quantitative relationships in infinite regress, I must also explicitly locate, relative to ourselves or our usual tacit standards, the arbitrary "zero" potential. And *I* can not locate such a "beginning point" of measures except for myself alone; it requires general agreement of people (§171k); you *might* agree with my zero potential, but by the theory of chance you probably wouldn't, and then I would be involved in an "argument" or controversy with you as to (say) how many pounds is a "heavy" load—which is not the purpose of this book. I propose to give here the *principles* or theory of all measures or descriptions; my guesses at those actual measures are *my* guesses, and you verify the book by using *your* guesses or opinions. So my avoidance of entering into any extended statement of direction is simply my generalized avoidance of imposing my opinions or standards on anyone. You really want to form your own standards and need to at first—though in this generalized form the need is yet obscure. I shall give some examples in the next paragraph.

c. The conventional technical example is an electrical

current. It is now generally admitted that there is a flow [of what is actually matter] not as the "positive" current, but in the direction which is called "negative." So the guess made over a century ago as to the "direction" of electricity is verbally contradictory to ordinary standards of zero 'molar potential.' —— We may take a wider case. When a filament gives birth to a secondary or smaller whirl, that filament at the time decreases—or we would conventionally usually say it degenerates or runs down or loses. But verbally contrary to that, when *people* give birth to a second generation, we commonly say the race is evoluting, or progressing—implying a growth or increase. The trick in the naming of such "directions" is of course as to where we take the "zero" and begin to count from. In the absolute, there is no such "start" or zero mark on a scale (§80). In the birth of people, our "start" is the *race*, and we ignore the individuals who, as such, decrease and finally die. In the birth of a secondary whirl I took the filament before the birth as standard; of course, the filament itself previous to that pregnant condition had to grow before it could decrease.

d. So it is obvious that I may not properly state directions in this book in any extensive connections. If I say the race is progressing, I have to state that it is my opinion or quantitative observation or guess that it is moving in that direction; and I have to go further, in order to show that the opinion is based on consistent statement of observation, and show that the climate, by being fairly steady for probably two or three hundred centuries, accounts for it, and further state that quite possible changes in climate may at times in the past have caused the opposite for a while (Index, "Climate"). It therefore follows that anybody, by taking a different point of view of the directions which I do happen to state in much brevity, may show that they should be reversed, in his point of view. I agree that he is right. But even more confusing than that, by the theory of chances it is going to be found that some of the few directions I do state (when it seems more economical of space, I name a direction, or guess) are going to be found to be mutually inconsistent whenever they are followed out considerably further, with careful measures taken all along. Those inconsistencies are quantitative errors, and are due to the fact that I do not know the measures, they often not having been made by anybody; those errors are also due to the fact that I can not carry very many facts in my memory at once, and hence get confused sometimes with measures that *are* available. However, those inconsistent guesses which I occasionally make at relative measures do not vitiate the principles or logic, as is explicitly proved by the whole of Part One. They merely prove that I am incompetent to give the reader any quite reliable practical (i. e., pluralistic or Many) advice or information. In short, there is no exact science, and I personally am unable to make science as exact as available information would permit.

§100. a. We may sum up what has been made obvious about whirls in general. The summary is a concrete or "tangible" restatement of the whole argument of the book.

b. (1) Any part of the universe may be considered mechanically as being a whirl. If we take a part as a whirl, then we have thereby explicitly implied a certain filament difference surface, which has (truistically) a fairly definite velocity; and that in turn, by the truism of continuity, establishes or implies every other whirl in the universe, because the same relationships that hold in the first whirl must be consistently identical in all the others. The relationships in the first or standard whirl thus established are definite (i. e., there is a difference surface velocity that is definite) within the degree of accuracy that is (A) possible to our perceptions (if we have actually-measured velocities), or (B) which we care to assume formally if we do not wish actually to measure. That degree of definiteness establishes the size of the cell—which is a smaller whirl we consider a vague, internally unmeasured unit. Only by regarding that cell as a geometrical point could we obtain *accuracy*; and in that case we would require an impractical infinity of words. Therefore, we take or verbally agree on the practical quantitatively vague cell (or small whirl); and that, from two points of view, allows—and verbally necessitates as a truism —all other whirls to vary widely (i. e., to exhibit all phenomena) even though they are, as has been shown, formally fixed by the first:- (1) Certain limits of variation are possible *to the cell* to begin with; when, e. g., those variations are multiplied by millions (by the inverse square law) in traveling out to a distant whirl, there obviously can consistently be considerable variability in the whirl (that is the fundamental reason for harmonic periodicity, or the periodic table of elements—stated in a new way). (2) We have no practical means of actually verbally keeping the *limits* of the cell *measurably* steady (getting rid of the infinite regress); so in practice those limits themselves vary, which adds to the other variations; but *formally* in this book, and also implicitly in practical life, we consider that variation to be zero; and because it is not, assert that we are always inaccurate, or that there is no exact science. —— Those two verbal "reasons" or truisms or explanations of why there *are* phenomena or changes, are obviously identical.

c. We hence see further, from the last paragraph, that in practice our description of the universe begins anthropocentrically. Each of us takes himself (his body and-or mind) as being a whirl—a $This_e$. That primarily "fixes" all molar bodies. Then by observing more closely (requiring some millions of years of nervous "evolution"), we name parts of ourselves (with temporary undue self-consciousness:- "they knew that they were naked"; Gen. 3, 7) and hence of molar bodies, until we now have carried the splitting down to electrons as being definite whirls or molar bodies of a "lower" order. Then, we can observe even more minutely; but at that next step in splitting we consider no longer that there are definitely lower order whirls (we validly could: cf. corpuscular light in XIII), but consider the whirl "continuous" cells, as has been seen in this, and the last chapter. Obviously in that process we use the difference surface of our skin as a criterion—we adopt the effective velocities of its structures as the particular one(s) by which to gauge and describe the universe (e. g., the Adam and Eve myth intuitively mentioned correctly that skin standard, by "naked"; except for that, and other substantial implied truths in the myth—for instance, the fact that the race for ages have been tackling the job of formulating this book, particularly Part One,—the story would not have survived long). So when we get things split down to vibrations, we find—because we originally put it in—a continuous and obvious velocity relationship, V_1 (IX). And then the total universe becomes established *for us* as being whirls (or any other formal structure or 'splitting') on the criterion of the velocity of our light V_1. Therefore, *if* orthodoxly we hold that V_1 is an absolute constant, obviously we make the universe consist of parts absolutely different to (for) each one of us, and each part differs (to each one of us) at each instant from itself at other instants, and we then have an absolutely anthropocentric universe (which is in principle the relativity theory; §66). That anthropocentric universe obviously has the difficulty of requiring a separate language for each person, etc. (§66). But we see again that such a universe is logically valid, or is consistent and "true"—just as Ptolemaic astronomy, which

is geocentric, *can* be expressed consistently. But that astronomy is grossly impractical; it would verbally give some of the stars terrific velocities, and thus (e. g., in order to have verbal consistency with such velocities) require complete revision of the expression of the properties and structures of atoms—in short would force us to revise our ordinary way of naming things. Also, unless that anthropocentricism, geocentricism, etc., or *any*-centricism, go to the ultimate limit (formally at least) of splitting things down to geometrical points it will become illogical (because a man, etc., is himself *variable*—and (2) in the last paragraph applies). No sort of orthodox 'centricism' does that ultimate splitting in practice; so all are both illogical and inaccurate, except Einstein's in pure formality (§66). I. e., such a theory which asserts any physical "constant," uses something finite (a part of the Many) as an absolute center (or as an absolute standard of measure—which is logically the same thing), and hence is illogical and inaccurate. (As we saw, theories like Thomson's electrons, Reynolds's, Richards's, Reeve's, and Einstein's agree with that either by explicitly implying that there are no such constants, or by formally going to the necessary *infinite* splitting; Einstein's book, §66, seems to be inclined to overdo the thing by doing both, which, if he so intends, would be wrong, and a new variety of meaninglessness.) —— Therefore, this book explicitly uses that *practical* anthropocentric *start*, formally asserts that man varies, or is approximate and not absolute, and thus logically uses an absolute no-center; i. e., the universe or the One is the *only* center or constant.[100c] —— Man is so accustomed to using himself as an exact or absolute center or standard (without however noticing that the use of a scientific infinite pluralism makes himself formally or logically be conceived as *coincident* with the absolute unit of the Many that he temporarily mentions; §66) that he often fails to see that he does, and denies it. Yet it is glaring, in every bit of classic logic and in all the orthodox dualisms, that man creates God in man's image—that man substantially takes himself as a finite entity, and by "multiplying" himself in size by about a thousand (which is about as "high" as a barbarian can think) gets what is actually a formally finite God; e. g., Jehovah, and the God of Aquinas, and the late Kaiser's Gott. All of us Occidentals tend however (as mentioned in the footnote) to think in no-centricism, or with the universe or the One God as the final standard. But we are so much in the bad habit of using classical or theological logic, and of failing to shift to an actually absolute infinite pluralism which would be correct enough (multiplying man by an absolute infinity to get God is correct; the materialists are our present-day barbarians who can't think so "high," but stop at an exaggeratedly emphasized finite anthropocentricism), that we are a bit puzzled by the verbal sound of this no-centricism, or definite *That...*$\times$*This...*, when I state it explicitly. That puzzlement is simply the difficulty that our nervous systems always have in making a previously vague and indefinite and dreamy idea into something more precise and useful. If in addition to making that no-centric step definitely in this book, I were to go on and make the last step mentioned in the footnote, that puzzlement would be possibly too much; as it is, there will be a number of persons with brains so weak and soft and flabby that their nervous systems can't make the no-center step, which most of us have already made in practice; I fancy some of those will be so senile that they will exhibit their weakness by public protests. But I think that the majority of Americans are strong enough to make also the last step of the footnote within a century. When that is made, the aristocratic exploiters who befuddle stupid men's minds will find their field unprofitably narrow.

d. (2) Next, we have seen in general that any whirl consists of ether in motion, the velocities of which ether reach a maximum in the difference surface, and decrease (so far as just one whirl is concerned) as the distance from that surface increases. (That is Bernoulli's principle in another form.) Obviously if we had in the universe a stream of ether which had a greater velocity than the streams on either side of it, then as a truism that stream must finally close on itself

[100c] It probably is better to be more explicit on that point:- Throughout this book I take the everyday general or summed-up language agreement that the One is "real" (§49g); and that is eqivalent to *no*-center, in the sense that the One is everywhere, and hence my center or standard is everywhere at once—which usually is expressed as *no center*. —— Now, that agreement which I use makes the logic or form of the book easier to follow. It however is *not* essential. We can, as just shown again, use an infinite pluralism as "real," and in that case the correct thing to do would be to have *each thing* that was mentioned be *temporarily* the absolute center and standard of the universe—to have finally an infinity of centers—or, so to speak, to use anthropocentricism absolutely but with a new or changed man every time. —— Further, it was seen (§49) that valid logic is a dynamic logic that shifts the "reality" of each part of the Trinity to apply to the part being used momentarily. So it follows that after a time, when men have learned to use language with much skill (implying great brain development), a valid description of some length will *shift* its "reality" from (1) no-centricism, to (2) infinite-centricism or *absolute*-anthropocentricism, to (3) an at present unnamed and practically unrecognized ignoring of centers by making relationships "real," or by speaking temporarily in terms of "abstractions" as if they were *the* reality. Such a valid description will shift its 'centers,' etc., as the viewpoint shifts—using (say) one center for a chapter, and then changing:- Thus *science* would as the most direct way of talking use infinite-centricism; *religion*, the third way mentioned above; *philosophy*, and *religion as we now ordinarily use it consistently* would use the no-centricism or first way, which as stated is the everyday "reality" *nowadays*, and hence the most familiar, and so the one this book uses (cf. §39). In short, this book uses what in time will be found not to be the best way: in time the dynamic logic with its varying "reality" of the three Trinity forms will be 'expanded' *explicitly* to what we might call 'dynamic-thinking' with a corresponding varying reality of the three forms or ways of conceiving truth (cf. §39; the idea is as old as our history but has no definite explicit names:- by proper dynamic-thinking the *subject-matter* of religion, science, and philosophy is identical, but for convenience and full intelligibility of expression the three *ways* will be used as just stated). My way in this book of emphasizing the reality of monotheism or Many-*continuity* or Many-*One* is the conventional, the Occidental way. It seems historically to be a reaction from the gross materialism into which anthropocentricism always—even now—tends to fall, and also a reaction from the religious abstractions of the Orient, that always tended to make people good-for-nothing in practical affairs. So it seems reasonable that we first get skill in our hardest way of the three, before trying the still harder and ultimate way of using all three as described (in which event we will be protected from the grave dangers of the easier ways—in all "soft-snaps" it is correspondingly easy to get into trouble). —— As an example of what is stated in this footnote (and the example is the concrete thing which caused me to add the footnote), the reader is referred to Jordan's Introduction. In it, when he talks of science he uses infinite centricism—inclines towards using infinite pluralism *without* however insisting that infinite pluralism is the "truth" or the only way. Then he substantially shifts to a use of no-centricism when he sums up (particularly in summing biology). Jordan thus is using valid logic in its ultimate 'expanded' form—a trick of skill in using language that probably not a half dozen men have the emotional strength to achieve, or the intelligence to use consistently without confusion. But to repeat, that ultimate dynamic form of speech is too hard to understand for an elementary book like this (as proof of that, see the remarks about British biologists in §147, who, perhaps without even knowing what they were up to, have failed to follow Jordan all the way in that full dynamic form of expression—although as shown, in bare logic they may be considered correct). Also, that final way Jordan is using is so hard to stick to that I doubt whether I could have been successful at it if I had tried it in this whole book. As a matter of fact, this very statement of the ultimate dynamic expression is hard to make clear; what it sums to is that science, religion, and philosophy are identical in subject matter, and that the three sorts of 'centers' determining their forms should be shifted as the point of view changes.

in three dimensions: so we have as a result of that closing a whirl. Then, if the velocity of the ether decreases as we go from the difference surface towards the filiar axis, it follows that there must formally be ether on that axis at zero velocity. But clearly, that can be possible only if there is a part of the ether which is a geometrical point; hence, we see again that there must be an infinite regress of parts in the cell, and that no cell, in our Many language, itself has such zero velocity—which truistically would take infinite energy to start it going again. Also, as we leave the difference surface and travel out into the field the velocity decreases so long as we decrease our perpendicular distance from the filament surface, down to the limit of velocity at which the adjacent whirls are in fair equilibrium (or until we come to an analogous balance near the *main axis* of the whirl). At that zone, obviously another field, of another filament, would commence (or at the main axis, the opposite part of the field of the same filament, with increasing velocity), and there would be a field difference surface.

e. It is truistic that such a place of fairly balanced equilibrium could occur inside either the original filament or field; consequently, there may be secondary whirls inside of either filament or field—and tertiary whirls inside the fields or filaments of the secondaries; and fourth order whirls, etc., in infinite regress, down through the finite whirls we have arbitrarily taken as cells, to ultimately point-cells. And in the same way there could be no "upper" limit of orders of whirls. If we arbitrarily took a given whirl as being the ultimate upper limit, it would be a One; its field would then decrease in velocity towards its field surface, and reach absolute zero at that zone or surface, which would then be the outer boundary of the universe. But evidently, as that outer boundary *is* zero, *it differs in no respect from the pseudo "outside" of the universe.* "Outside" is hence absolute zero.

f. It can further be seen, as a truism, that there can be no actual upper limit of velocity, regardless of what velocity we practically use as a prime or standard velocity for splitting the universe (i. e., V_1 is by no means an absolute upper limit of velocity, but it *is* the highest velocity that can occur except *inside* our atoms, as will appear). For obviously, at any place in any order whirl there may be a field surface, and on account of previous asymmetries the field velocities on one side of it may increase very rapidly (have a high gradient) to any velocity; we shall see that truistically there must be such high gradients. It is obvious that if that velocity is higher than V_1, then the ether structure suitable to be used to express such velocity must be smaller than ordinary atoms; for clearly, the *effective* structures or atoms that we select to give our ordinary light are, considered as whirls, determined by filament surfaces at V_1 (XIII). Evidently, if in a very minute cell, considered as a whirl, the filament surface velocity became infinite, then the *formally* still smaller cells that composed that filament surface would become points or zero, that difference surface would become an exact geometrical surface, the point cells would then turn in at exactly 90°, and infinite energy would thus be displayed at each point, as a result of each such birth (and those births would be infinite in number—or zero, just as you prefer, because clearly the whole whirl truistically reduces to a point); or the energy would be zero, as each point cell was zero. Obviously that gives the "concrete" details of the infinite regress (IV-VI). That is another explicit way to reduce the universe verbally to an absolute pluralism: obviously such pluralism is identical except in verbal form to monism.

g. It therefore truistically follows from the last paragraph that there exist coincident with this universe of ours—this V_1 universe—an indefinite number of other universes. That is an old idea; those other universes are conventionally vaguely known as astral planes, heaven, hell, spirit world, etc. But there is one very important practical mistake in the conventional idea of them:- they are obviously truistically *not* essentially *different* or *separate* from this universe we ordinarily name and explicitly talk about in our positive terms, but are merely verbally quantitatively different universes which have standard basic structures with surface velocities different from V_1 *in any degree we arbitrarily care to take.* I. e., we can name and describe just as many of those "new" universes as we like; they all truly exist: but every one of them is inseparably bound up in our ordinary one, coincident with it, and if we (say) stub our toe, *all* those additional universes are definitely included in the sensation and general reaction labeled "toe stubbed." Hence, it is ordinarily a waste of time to be explicit about those others. —— Also, as a different form of the same idea, there is obviously an infinite regress of parts or structures of different order:- secondary whirls, tertiary whirls, etc. E. g., our solar system can be an ether cell in some larger man, as we saw. But in the same way as just above, that makes no practical difference to us. For if that larger man has (say) a thought, its effect on us actually exists (perhaps it will quickly *to him* smash up our solar sytem—and do it in a few billions of *our* years *to us*), but that effect is included in our ordinary *That...*$\times$*This...*, and we usually need not go formulating different order languages to talk about that effect. —— This ad infinitum duplication of universes themselves obviously corresponds to the ad infinitum duplication of languages shown in VIII. And we get the same conclusion:- that the average man with his age-long commonsense has adequately (even if not quite consciously to himself) collected the whole affair into his everyday point of view.

h. (3) Next, it has been seen that in general there are pluralistically no perfect whirls. E. g., in par. f, when the difference surface became a geometrical surface, we lapsed into mysticism. So it is clear that there may be any (finite) degree of indefiniteness about a whirl. *Any* difference of velocity implies a whirl of some nature. But such a whirl may not have time to form very far. Only in a space where there is comparatively steady equilibrium can whirls which are relatively large for that size space form. (That can be seen readily by a brief consideration of those spaces and times; or the various experiments shown hereafter make it directly obvious.) Several important points of view of that inexactness or lack of perfection of whirls are obvious:-

i. Perhaps the most important point of view is that it means that there are no "perfect" phenomena. I. e., *all* phenomena are simply the changes in whirls; and hence no phenomenon may consistently be pluralistically sharply distinguished from any other (except in *infinite* pluralism). That is identical with §83fg, and I need not repeat further.

j. But precisely the same thing concretely accounts for what is conventionally called the *purpose* in the world. Of course it *is* "purpose," in the real meaning of the word; I am simply going to express *purpose* pluralistically here; usually, it is oratorically used in a monistic, mystic way that is at least not clear. When I express it consistently pluralistically also, then I have absolutely explained it. Some of the conventional figurative ways in which the idea of purpose is validly pluralistically expressed are:- water seeks its own level; in an otherwise fairly steady environment temperatures tend to equalize; birds of a feather flock together. —— If at any place there are whirls of the same order in which the velocities of the difference surfaces are considerably different from each other, then as a truism there are considerable asymmetries. Those asymmetries would, as a

further truism, keep on forming whirls of other orders until the various velocities had become fairly equalized. So over any space in the universe which is large compared with the size of bodies of the most usual order in it, there is fairly steady equilibrium for those bodies. That is equivalent to the fact observed long ago, that "nature makes no leaps," has no catastrophes, or displays fair uniformity. But from our way of saying and observing that here, at once we see that bodies of the same general order tend to collect together, thus forming with more or less definiteness a structure of a higher order; or, the reverse way of stating the fact is the easy and more familiar and intelligible negative way:- whirls of a given order that are in the majority will drive away or change into their own order ("destroy") whirls which are out of balance with themselves (just as men fight when they get badly out of balance or in "disagreement"). Thus, certain bodies collect together as the solar system. In one of those bodies, the earth, there collect secondary bodies, men, who are of such a great difference in order or of potential from the earth that they scarcely interfere with it. In men, certain physiologic cells of the same kind have collected—into "differentiated" organs. In the earth, to a certain extent atoms and molecules of the same kind have collected together. Briefly, all of what we commonly call progress, or what looks to be "purpose" towards some systematic or unified end, actually is so; but it is also true that it is, in more precise and intelligible words, an exhibition of this truistic or "mechanical" tendency to smooth out asymmetries among neighboring bodies, up to a certain quantitative point. —— Now, if all bodies were sufficiently close to each other quantitatively in what I have here been calling 'order' or potential, the majority obviously would steadily tend to wipe out the others, so that the orthodox increase of entropy (§80) would be true. But when the quantitative disparity in 'order' or 'potential' reaches a certain ratio or proportion (the theory of which I call 'harmonic periodicity'; see Index), then whirls of one order do not much interfere with or destroy those of the different order, for the reason that, so to speak, they can't "get bold of each other" (that refers to a comparatively *brief* time); e. g., it would be practically impossible to handle a pin directly or at once with a 100-ton crane; and as mentioned above, man and the solar system do not in brief times directly interfere. (Incidentally, in agreement with that practical point, in other places in the book I use the phrase 'order of structure,' etc., to mean such considerable quantitative difference.) —— Consequently, there is eternally a two-fold aspect, or mechanical reaction, in the universe, showing it to be truistically an absolutely automatic (i. e., perfect) machine:- (1) bodies of the same order or "sort" tend to collect, to "fit" together, to come together (and in doing so to smooth out, "destroy," each other's inevitable slight variations—just as men are "well bred") in a "purposive," suitable way, "appropriate to some end" (as we saw in §86d); (2) on the contrary, the precisely similar efforts of bodies of a *slightly* different order from those just mentioned, to do similar things for *themselves* tend to destroy both themselves and also the first collection when the two sets are more or less neighbors, and the result is that the two sets of bodies are to some degree driven apart spacially, the remainder of the reaction being that the part of the less energetic set which doesn't get away is destroyed —i. e., changed—into whirls of *considerably* different order, so that the resulting two sets can stay together without much interference for a *long time* (i. e., they are 'separated' *temporally* instead of *spacially*—an important mathematical point quite overlooked by Clausius, but which is implied by Einstein). Thus, a difference of potential is built up at the same time that potential is smoothed out—and the process is eternally reversible. The process is very easily seen in the history of men (it applies to all natural structures) in the so-called rise and fall of nations; a very superficial knowledge of these principles shows that there is no need of a nation's "falling," as a very mediumly intelligent application of the principles will reverse the direction at any stage—given a fairly steady climate. —— Truistically, the sum total of that oscillating effect is zero—or infinity, if we speak "optimistically." But because human beings started their *language* anthropocentrically, anything of a different order that tends to break up humans (to change their supreme *This*, which is themselves) they call *evil*, thus asserting that there is *no* purpose; and then they worry over the "problem" of Good (or Purpose) and Evil which is thus started. —— This paragraph is the general concrete or physical solution (1) of that problem of *purpose*, (2) of all geological segregation, (3) of the stability of the solar system or any other natural structure, and at the same time (4) expresses the reasons for all "chemical reactions" (it being the underlying principles of what is technically known as Gibbs's phase law), and (5) gives the reasons for biologic "trophisms" (XVI). The paragraph also (6) directly implies the general theory or reasons for the periodic table—is the concrete or *That...* × *This...* expression of harmonic periodicity. Also, it (7) directly implies the total theory and methods (see §§140-1) of how to get available energy out of any collection of whirls (or put it in; it always is put in first somehow; but truistically *if* we could use the velocity of an atom down to the zero velocity on the filiar axis, *there would be taken out of that atom infinite energy*; however, it also truistically would take infinite time to get that much out). Necessary details of such problems are shown later by direct experiment. Volumes of such details are omitted. A direct extension of this paragraph is given by §101f.

k. The last point of view which we have to consider of the fact that whirls are of all degrees of perfection (see par. h) is that just as the multitude of resulting quantitative details is difficult to handle mathematically, so it is difficult to see experimentally all the numerous details and describe them 'verbally.' But it can be done experimentally and verbally better (at first), as I propose to do it in this Part, than it can be done mathematically (in the way indicated in IX with the measuring member). E. g., the phenomenon of heat is a considerably confused secondary whirl formation, which occurs whenever any appreciable asymmetry of whirls of the same order occurs.

l. It is therefore a direct truism that it is not possible to describe any experimental whirls accurately. We can not even observe them definitely in much detail, compared with the infinite detail they exhibit. We shall become aware of that clearly when in the next section we begin with the direct experimental proof of the mechanics of whirls. But it is better to be thus admittedly quantitatively inaccurate concerning things as they actually are, than it is to talk in the old dualism about frictionless bodies, perfect gases, or constant anything, when no such things exist. Many great artists in various lines have been praiseworthily notable for giving a sense of "mystery" by their productions. That sort of mystery is good, as it is the truth, being simply their intelligible expression of the fact that quantitative details go on infinitely so that all are not perceptibly expressed. There is no proper reason why science, particularly mechanics and physics, should not be more clearly truthful, and "human," and beautiful, and useful than the work of those artists.

m. (4) The last general thing which we saw about whirls is that a whirl completely fills the requirements of all

machines (§86f), and is a concrete model of Newton's laws. —— (A) For first, each whirl consists of at least two reacting parts:- the filament, or *This...*; and the field, or *That...*. We may note that the reaction between a given cell in the field and a given cell in the filament is identical in principle with a lever, of which intervening cells form the arms (§98b), and the difference surface the fulcrum (specifically, it is a bell-crank lever; see Fig. 98q). That fulcrum is truistically not a point—which agrees with fact about an ordinary actual lever. Also, it may be observed that the experiment made with the cog wheels (§98b) to show the nature of cohesion, very directly shows that cells are in principle levers. And it can be noted from §98x that whirls are mechanically equivalent to inclined planes. And if we consider the single line of motion of a cell (§98m), it is obvious that a whirl may be considered a pulley (the difference surface is the pulley wheel). All those fundamental conventional machines are obviously merely forms of levers, as has been orthodoxly recognized for years. And it is clear that a whirl includes them all. —— (B) Further, each whirl includes (even if only vaguely and implicitly inside the cells) the dots of the formally consistent *That...*×*This...*. There may be as many 'explicit' or concrete dots as we like, in the form of secondary, tertiary, etc., whirls, on "down" to the absolute limiting One zero point-cell. As a truism of that characteristic of cells as a model, we saw that our machine exhibits all the phenomena of growth and purpose, just as a "person" does—that the so-called machine, when it is really a valid or workable machine, has those personal or "human" characteristics. Now, the truth of the matter is that any actual or experimental *lever*, properly and consistently considered (cf. §47), will promptly extend itself to include the total universe as a vast inseparable system of levers, any one of which formally gives 'birth' in either direction to infra-levers and super-levers. But we are not accustomed to thinking of levers that way; emotionally we are myth-ridden by the classic logic perfect lever with rigid line-arms and absolutely constant point fulcrum. Such myths are excellent perhaps as preliminary verbal steps for untrained observers; but certainly nobody should "believe" such abstractions.

n. It is so obvious that a whirl exhibits the solution of the One and Many, as do Newton's laws, that no summary statement seems to be needed of how it does. So we are ready to look at some whirls experimentally, and thus synthesize all the above rather lengthy talk into a single comprehended working idea of a Many part.

§101. a. The remainder of this Part Two will be chiefly devoted to observing actual whirls, as a means of understanding and applying the foregoing concrete way of naming *That...*'s and *This...*'s. Probably the simplest and easiest whirls to make and observe are those formed by dropping soapy water off the side of one's hand into a fairly large basin of water. If the reader will do that occasionally when he washes his hands, then probably without much expenditure of time and effort he can see directly for himself the truth of all the foregoing truistic mechanics.

b. Whirls which travel slowly are the best sort for seeing the important reactions—and even then whirls often split into secondary whirls so rapidly that to see them it is necessary to observe attentively. So far as I have observed, any ordinary variety of castile soap will make a solution with water of the proper viscousness or cohesiveness to produce fairly slow whirls. I have tried numbers of other ordinary toilet and kitchen soaps, and all produced whirls that traveled faster—usually reacting too fast to see much detail. If the basin holds considerable water there is of course more room for the whirls to react in. And it is well to have the water fairly steady—at first, anyway. Afterwards an indefinite variety of disturbances may be given the water, there being no end to the variety of whirls and part-formed whirls which may thus be visibly made. Also, if the experimenter's hands are rather dirty before making these whirls the whirls will be more easily visible. —— Similar whirls can by made with numerous visible liquid solutions, using apparatus of varying degrees of elaborateness, starting with fountain pen fillers and going beyond million dollar laboratories. I mentioned the most easily applied way, which I chiefly used for about two years in order to formulate the general mechanics I have just given.

c. If the hand be held so that a thick soapy drop (with no appreciable bubbles included) will fall from the flat or outside edge of the hand held down (so that the drop itself will not be rotating inside itself very much), for a distance of three to six inches to the surface of the water, then the drop enters the water with a velocity sufficiently greater than the then surrounding water to form a well-defined whirl which slowly moves downward, with its main axis about vertical, so that from above we see the filament as a ring. A considerable part of the drop of soapy water is at first in a confused looking field about the filament; but by the mechanics we have seen, that field spreads or extends out until it becomes rather imperceptible and we see chiefly the filament, with a perceptibly indefinite surface.

d. If the whirl forms in a condition of unusually steady equilibrium it will look from the *side*, in cross-section, like the top figure in Fig. 98n; the rotation of the filament and field would be the same as shown by the arrows in that figure, and it would therefore travel downward in practically still water. Usually, however, an experimental whirl is soon noticeably asymmetrical. A bulge will begin to grow at some place on the outer side of the filament (cf. Fig. 98w; obviously the field inside the ring is held steady by the ring, and it in turn steadies that ring or filament so that ordinarily a bulge does not grow on the inner side of the ring—towards the hole in the doughnut). That bulge will then break out or away as a secondary whirl (Fig. 98w)—with its filament appearing edge on to the experimenter from above. It will comparatively rapidly travel out a little way perpendicularly to the main axis and to the original surface of the filament where it formed, and slowly tilt over and as a result start downward. Sometimes, if the primary whirl has bounced up from the bottom of the basin before a secondary is born, the secondary will turn upwards. Also, if the whole primary whirl has been almost symmetrical, and has traveled down slowly, it develops more than one bulge on its filament; then it may break up apparently wholly into two or more secondaries at roughly the same time. I have seen a whirl break into as high as probably fifteen to twenty secondaries; such very small secondaries react so fast that it is hard to observe them. Also, it is occasionally possible to observe a secondary give off a secondary of its own (a tertiary), and two or three times I think I have seen a fourth generation.

e. Another important phenomenon to be observed is that when a secondary breaks out of a filament it retains (often long enough to be easily seen) a distinctly visible film of soapy water connection with the filament, which film is like the sides of a barrel, except that it bulges *in* all around instead of *out* (is roughly a hyperbolic 'surface' or zone of revolution). The secondary filament or ring 'sits' on one rim of that tubular surface, and the other rim merges into the primary filament. Sometimes that connection will perceptibly stretch out to comparatively great distances, becoming attenuated to the apparent thickness of a thread. Now, that connection between the primary and secondary whirls

consists of actual water 'cells,' strung out in identically the same sort of spiral or helical nearly right-angle turn described and pictured in §98q. Here we have a number of such paths in a summed up condition, and made of visible globules or cells of soapy water, so that we can see the sum. The phenomenon (by §98l) would obviously be no different if the whirls were ether instead of water. It is indicated in Fig. 101e that those spiral paths, making about a 90° turn, would sum into such a surface. If a whirl be made of smoke in air, it usually on breaking up leaves considerable of such visible connecting surfaces or summed spiral paths.

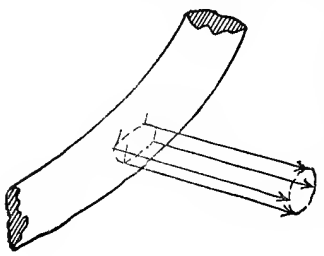


Fig. 101e.

f. Those paths would (as shown in §98t) finally at any exact instant be unified into just one path with infinite velocity. But because we are using actually finite bodies, in finite time, we get a visible sum of paths. Hence, we can directly from those experimental whirls now observe what in the discussion of "purpose" (§100j) we called 'birds of a feather flocking together,' and give it a more intelligible name. We note that with a certain lack of equilibrium a bulge grows or *accumulates* on the filament, instead of there being a more or less instantaneous correction of it by the giving off of say one water cell. That is because water as water (i. e., *as* a Many —and not mystically or in the "pure" abstraction or metaphysics sometimes mistaken for science) is truistically not perfectly homogeneous (has a lot of unequal, smaller, asymmetrical structures in infinite regress, even apart from the soap, etc., in these experimental whirls; that lack of perfect homogeneity applies in every respect; e. g., chemically "pure" water is not "perfect" H_2O, but contains variable molecules); or, in general, there is no exact science. So there is truistically a certain amount of accumulation of unbalance; the equilibrium begins to be restored by movement of the very small structures which are imperceptible to us, and it takes time to show an effect in the larger ones—to show the bulge. We can take it simply that "water" structures are of finite size, and like bricks in a wall require a finite accumulation of energy to dislodge them. Then, when that unbalance or potential *accumulates* enough, the secondary whirl is born. It seems to us "fitting" that it should be born; for a perceptible length of *time* we can notice that the filament, so to speak, *intended* or *purposed* to give birth to the secondary. No dualistic science—nothing in the classical logic—will with verbal consistency permit any such phenomenon to happen: such science says it is logically impossible, and yet it does happen before our eyes. For by classic logic effect must follow cause instantaneously in the sense that any force at once produces motion. Well; the actual *pluralistic* fact is that *never* does any force which we say we "measure" *instantly* start its motion or produce its effect: *always* in *science*—in consistent *positive* language which is not formally mystic or religious expression—there is a *lag in time*. The orthodox way of assuming and asserting that a reaction is prompt on action is merely a One form of speech—true as a One or zero or infinity; for the reaction does begin instantaneously on the *zero* parts at the end of the infinite regress. Classic logic and dualism having thus omitted *positive* statement of that time lag which is pluralistically usually glaringly perceptible especially in biological phenomena, and having further formally or logically denied the possibility of any such thing, naturally commonsense persons observed the existence of lag—naming it, in general, *purpose*. Then, truistically "purpose" could not conventionally be explained as it had been "logically" denied. —— That time lag implies an accumulation of energy or motion which then obviously as a truism (and also by direct observation) goes too far—*overruns*, so to speak,—and then bounces back some. Hence, including that second and completing result (that 'bounce' is of course in infinite regress:—all this is obviously merely a detailing in physical terms of the theory of incommensurability, and the incommensurability is not 'finished' by one bounce or any finite number), we call this phenomenon of an accumulation or summing of results by various conventional names, depending on the way we look at it:- purpose or intention, will (volition), lag (with its numerous technical synonyms:- hysteresis, viscosity, elasticity in some senses, latent heat, potential energy, etc.), overrunning, *rhythm*, *vibration* (as of an ether cell—and our use of those last two terms will thus have a more extended meaning than is conventional), etc. Generally I shall use for this total aspect of that summing up of effects (which is a deriving of *That...* by beginning, so to speak, with the last dot and building up the *That...* by going backwards), due truistically to the finite size of parts, the names *overrunning*, *rhythm*, or *vibration*. Obviously, rhythm is a universal property of the Many. The orbit of the earth is a rhythm ("music of the spheres"—though "music" implies a perceptibly sustained and-or organized rhythm, which involves the definite addition of the principles of harmonic periodicity to conventional rhythm). All vibration is explicitly rhythmic; a pendulum is rhythmic. Even "free verse" is rhythmic—but perceptibly so only after a painful effort to perceive. But there is no perfect rhythm—no exact cycles short of the total universe. So there is no perfect music short of the One.

g. It may be directly observed, and consistently expressed as Bernoulli's theorem, that the filament throws off a secondary when it loses velocity or energy, or when the field relatively gains velocity or energy, so that the field has locally a relative asymmetry—i. e., locally its velocity tends to become greater than the maximum velocity which is or determines the difference surface, and hence truistically that surface has to change in some way. Or, it could be said that the inner field (the 'hole' in the doughnut) got energetic locally, thus pushed against the filament in some spot, and forced out a secondary on its other side, precisely analogously to a whirl gun (§102b). There are a number of direct ways of stating the actions and reactions of that phenomenon. —— It is then obvious that precisely the reverse can occur:- that the field loses considerable energy relative to a place on the filament, and gives birth to a secondary into it. We see that experimentally more definitely in §102d.

h. It is also obvious that it is theoretically possible for such secondary whirl formation to take place in either direction across the field difference surface with respect to *two* primary whirls, when there is considerable local asymmetry. I have never *directly* seen that occur with experimentally made whirls; but it is probable, e. g., that most ordinary electrons (they are indirectly observed) are such field surface secondaries (XIV). However, it is also clear that when two whirls which have joining fields are rather free to move (as is the case with the limited number of whirls which can be made somewhat simultaneously in the neighborhood of each other by the soapy water method), then an asymmetry of the two whirls is more likely to distribute itself rather evenly over the whole field surfaces (cf. history of solar system in XII), so that the two whirls repel or attract each other as a whole (as largely happens in electricity; XIV)—and in especially free conditions will alternately repel and attract in perceptible long-continued rhythm, the two alternately threading

through each other (§102b). If there is perceptible only a "repulsion," then truistically the two repelling whirls separate spacially, but in so doing would approach towards or be "attracted" by other whirls; i. e., as an obvious truism there can not be "repulsion" without equal "attraction" elsewhere, and vice versa.

i. If two whirls are attracted together in ways which do not start too much rhythmic change, the 'direction of birth' reverses, and the two *join together* into one whirl having one filament and one field. This larger whirl is of a "higher order," which we might call the first super-whirl. It is very difficult to form two soapy water whirls nearly enough simultaneously to join thus (i. e., the two drops have to hit the water almost exactly at the same time at a little distance apart, as otherwise there will be so much relative asymmetry between the two that they will not join—just as two rather different sorts of animals will not breed together). But such unions are readily produced in other ways (§102ef). This joining of whirls into superwhirls is a very common phenomenon, being simply the quantitative obverse of secondary whirl formation; in one side of the complete cycle the potential "increases," and in the other side the potential correspondingly "decreases"—which is which depending solely on point of view (§99b). E. g., the combination of ether cells into a definite whirl is the most general example of joining of whirls; in that case the *degree* of union is slight, just as it is in (say) the joining of two or more atomic whirls into a molecule, or in the bunching of molecules into a "higher" sort of molecule, such as a chemical "chain" or "ring" is sometimes. —— It should be noticed that when the *degree* of union is practically complete, as when two whirls unite to form one whirl without substantial surviving traces (asymmetries) of either, that larger whirl is conventionally called a different order; but there is no *essential* difference. By the theory of incommensurables there can be no perfect union, and hence the question of *order* of whirls depends truistically on the quantitative degree of union (cf. §100j)—and that is in infinite regress. —— And that joining of whirls will be shown to be equivalent in principle to the joining together of two one-cell organisms, or to ordinary fertilization in two germ-cells (XVI). A biologic cell is a whirl (just as the earth is), and is in principle equivalent to our ether cell, merely varying in L and T (XII, XVI).

j. That quantitative joining together of two whirls experimentally, or the reverse secondary whirl formation, truistically depends upon the *size* of the whirls compared with the size (energy) of the asymmetry. E. g., an asymmetry that would break a smoke ring into pieces too small to see well would be imperceptibly taken up by the solar whirl as a whole; or, reversing, an asymmetry that would affect the solar system perceptibly would be so comparatively huge that a smoke ring would pass through it mostly unchanged, in a short time (§100j). Thus there is truistically a rhythm, or *harmonic proportioning* of *sizes* (at a given *time*), due to (or which fundamentally *is*) the overrunning or accumulation of energy—and due fundamentally to the finite size of ether cells, which in turn truistically rests on the arbitrary splitting of things by V_1. Or, whirls which could form and survive in any given environment would occur in certain '*steps*' *in size*, with a very definite proportionality; i. e., this is the L aspect of the T aspect that was called *lag* in par. f. *That is the statement of the principle of the periodic table* (Appendix B). There is nothing esoteric or hard to understand about it. It is precisely the same principle as this:- that (say) a woman can not have a continuous or 'fluid' stream of children, but has to have them in stepladder order, with all sorts of variations *inside certain probable limits*, including possible quintuplets (say), which however are never exactly the same. The principle of harmonic proportions is the same as the general statement in par. f (except that harmonic proportions emphasizes L; or figuratively asserts concrete music—which of course lasts for a while, or includes T); or it is the same as the fact that "static" friction is for given substances a fairly fixed proportion greater than "dynamic" friction, but varies with substances; or that a given vessel may be overfilled with a given fluid in certain roughly definite proportions. In no case however can there be exactness; e. g., there is perceptibly no exact weight of the Pb atom, but what is called Pb are atoms which are in fair proportional equilibrium with other whirls in the environment and hence group themselves comparatively closely around some certain average weight, but exhibit some decided variations in even as general a property as weight where the past histories (environments) of the various Pb atoms have been somewhat different. The same principle of harmonic proportion is very apparent in biology; those different "elements" there are named "species," etc., and individuals of them vary perceptibly from each other, but group themselves around an "average." —— The definite measuring-discussion of that harmonic proportion—i. e., the explicit expansion of the scientific theory of *measurement*—is scarcely begun in the present day, as was noticed in IX; consequently, although the principle is simple, and recognized in various forms by nearly everybody, the expression of it is unfamiliar and hence gives an emotional feeling of puzzlement. Kelvin was right in saying that measurement was important in science (§2); but he did not do more than begin to say what "measurement" *is*—he just took it for granted that anybody with commonsense *knew*; and I am saying here that such is the case, but that that knowledge is exceedingly vague and is not definitely expressed. I shall give various *That...×This...* discussions of the principle hereafter. But that discussion also is rather novel verbally, and will lead us to things that although really simple seem hard at first because the details have not been very definitely observed by us. I don't know the details myself—merely the beginnings of them. For instance, it is obvious from this paragraph that theoretically in a chemical compound, because the "elements" are fairly stable in their proportional sizes or energy-contents, the different element atoms would not *in a great degree* join together into a superwhirl (obviously, if they did a new "element" would result—and under *suitable* conditions it is probable that such "new" elements do result; §118); but there would at least be *always a variable and slight degree of union* into larger structures or compounds (or biologic cells, organs, etc.) that are harmonically or spacially-proportionally fairly in symmetry. So in comparatively steady conditions we would have a "compound" that is a distribution or structure of "elementary atoms" in a "space lattice" in crystals, directly observed with perhaps most thoroughness by the Braggs with X-rays, and which is being worked on symbolically from a dynamic point of view by Langmuir (cf. also Erwin's "wheels"). So it becomes obvious that this general, seemingly abstract, theory is the foundation for getting definitely at atomic phenomona, structure, and measurement—implies the principles of solids, liquids, and gases. Some few of the facts about all that, and expansion of those principles into applicable details, are given below in suitable places. Most of them that are known to the experts I do not know; and comparatively only a few such facts are known to the experts. But it has appeared that such ignorance is quantitative—not essential.

k. The final general sort of phenomena which whirls display, and which may be directly observed in these experimental whirls, is the general *elastic* reaction, or various sorts

of *vibration* of the whirl. Primarily it is of course easily observed that there is no fixed or constant difference surface—the filament surface is visibly variable. That is the general principle of elasticity:- single cells have an infinite regress of parts, and hence no surface exactness can be shown anywhere. All phenomena are of course truistically ultimately such elasticity—it is simply another name for motion. But when we consider a whole whirl as for a time remaining *formally* a definite structure, then the whole whirl visibly varies, or is elastic: the filament moves back and forth, remaining 'the filament' (for marked and systematic experimental evidence of that, see §102). —— Inaccurately and briefly (it is a quantitative problem I have not worked out—for general implications of the probable truth of the guess to be given, see XIII), ordinary light is the wave motion from vibrations or rhythmic processes in atoms; X-rays are the waves from the rhythmic processes of secondaries in atoms (from 'electrons' inside atoms); and electricity is a collection of many atoms in a large or super-whirl or -whirls, so that electric waves come from the vibrations of the large fields or filaments of such whirls. Now, clearly the same harmonic periodicity of size would hold between the dimensions of such waves, as held with respect to the orders of whirls (taking *order* here in its full formal meaning of §100j). So in our ordinary *average* environment there would not be any persistent or stable and hence readily detectible waves between wireless waves and light waves; then there would be a similar rough gap between light waves and X-ray waves, just as there is a gap (including a difference also in properties) between C (atomic weight roughly 12) and N (14), or between an ape and a man. There is of course truistically possible (using the *full* meaning of *order*) a *continuous gamut* of waves, from those approaching the limit of infinite length that are the vibrations of the ultimate whirl which is the universe, down to those approaching zero length. But in a *particular* environment such as (say) ours, by that theory of harmonic periodicity there are those three "element" waves (each sort has considerable natural variation about its "average"; e. g., the different "colors"). By changing the environment sufficiently and for a long enough time we could produce *any* length of wave just as it is possible theoretically to produce any sort of chemical element of any weight, or as it is possible to change an ape into a man or vice versa (with *enough* knowledge we could take any given ape to pieces, and change the pieces and put them together as a man: it is a *quantitative* task—see XVI,—and *in principle every quantitative task is possible*, given enough L and T). —— This paragraph is theoretically consistent. Quantitatively there is not a sufficient amount of direct experimental proof, as this particular application of obviously true principles is somewhat novel. Hence, I am perforce guessing at quantities, and quite likely I am badly inaccurate in some guesses; e. g., there nearly certainly are 'organic' waves normally existent, which constitute an 'element wave' between electric or wireless waves and light. But there are no positive measures and conventional recognition of any such waves. Possibly the smallest size electric waves (I do not know how short the experimenters have now got such waves: perhaps to 0.1mm) will be finally shown to be near the size of waves that cause what is named telepathy, the "light" in a person's eyes, "personal magnetism," etc.; but it is rash to guess at such wave lengths. However, even if there are no such organic waves of an 'element' length of their own (and with absolute certainty, the brain and all sorts of organic cells will give off *some* length of wave; §146h), they are obviously nothing new. For light waves (say) truistically imply the existence of all sizes of waves. —— Also, as light waves may be said to be themselves actual whirls (§§124-5, 130), then *any* sort of wave may be considered explicitly a structure, or explicitly matter, and so they definitely show all the phenomena possible to any sort of "matter"—including "spirit" or "mind" (see Part Three). So theoretically there is no difficulty whatever in obtaining thoroughly consistent, intelligible, and so-called "concrete" explanation of all the table rappings, levitations, automatic messages and writings, etc., produced by "mediums" for the psychic researchers. Personally, I never observed any such phenomena except some I could see was a fraud (I have myself experienced some very inaccurate and uncontrollable telepathy, which is the *direct* form of most such phenomena that isn't fraudulent); but I believe that Carrington, Hyslop, and Flourney, e. g., have seen some such organic phenomena—mixed perhaps with considerable fraud which they have mistakenly thought genuine. (The difficulty with observing such phenomena is that most mediums have more than a touch of hysteria, and will deceive even themselves in their efforts to attract attention to themselves; hysterics frequently fool experienced physicians who are on their guard against just such a thing, with respect to commonplace doings: see Weir Mitchell's little book on hysterics, which gives some of the almost unbelievable deceptions practiced by them, and furnishes proof of this sentence. So they easily deceive scientists, who are not accustomed to dealing with liars; also, except after considerable dealing with hysteria, recognizing it as such and guarding against it, hysteria is temporarily very "catching"). —— However, although there are such "psychic" phenomena, genuine and easily explained, that by no means proves the existence of a "spirit world" or "spirits"; it actually disproves the existence of any such, as we implicitly see in §§152, 144, and elsewhere (Index, "Personality," "Immortality"). The truth is, as is truistic with the theory of this paragraph, that we have thus far in the existence of the race perceived merely a few spacially isolated spots on the unending gamut (or spectrum) of waves and-or molar "elements" (both are the same, as just seen). Not only have we failed to observe the vast majority of things that exist, but we have not formulated any very explicit statement of the existence of the vast majority of things. In a universal sense we are as narrow or provincial as many New Yorkers are in a mundane sense. Yet in spite of that limitation of vision, with which we have formerly been rather content, we shall never experience or observe anything with which we are not already thoroughly familiar in principle—anything which is not in general exhibited by a whirl.

§102. a. Practically all of those general phenomena of whirls can, as has been stated, be observed directly from the slow-moving soapy whirls. Such are needed for direct observation of many of the reactions. But well-formed whirls may be experimentally made in many ways, and in this section I shall mention some others which serve to verify details which are perhaps not clearly visible from the soapy whirls. *Any* relative change of velocity in a Many medium forms or starts forming a whirl or whirls; if the medium is comparatively fluid and conditions are fairly steady a perceptibly complete whirl will be formed.

b. Some smokers can make rather symmetrical smoke whirls. Volcanoes occasionally make them, as do locomotives. Smoke whirls may be made readily by using some sort of closed box having a hole of some sort in one side and one or more sides relatively flexible or elastic. (Put two or more holes fairly close together in order to make two or more whirls at approximately the same time.) If the box is filled with a visible fluid (e. g., smoke) and placed in a fluid medium of about the same, or greater, density (e. g., in air) a

sufficiently hard rap on a flexible side will force some fluid out through the hole, which fluid will form a visible, rather symmetrical whirl. Such a box is usually called a whirl gun. By varying the factors involved (sizes and shapes of holes, location of holes, elasticity of diaphragm, rap, densities and viscosities of fluids, etc.), indefinite variation in the whirls may be obtained. If the hole is not round, and conditions are otherwise fairly balanced, the filament vibrates markedly —substantially in the plane of the filiar axis. Also, as a well known experiment, if one whirl is made directly after another one, the leading whirl will often expand the diameter of its filiar axis (start what we might call a vibration as a whole), and attract the following one, which will contract its filiar diameter and thread through that increased hole in the first, and get ahead. Then, the new leader expands, the other finishes its whole vibration by contracting, etc., and the threading through is repeated—and so on, until the whirls wear out or hit something. That is equivalent to the rhythm of pendulum action.

c. An excellent experimental discussion of whirls is given by Northrup ("An Experimental Study of Vortex Motion in Liquids," "Jour. Franklin Inst.," 1911; reprinted "Sc. Am. Supp.," Sept. 28, Oct. 5, 12, 19, 1912). He made whirls of colored water and colored kerosine. He used a gun; and as the whirls moved rapidly, he photographed them. I shall give such description of his whirls as is needed to supplement what can readily be seen with the soapy whirls. That will be but a small part of his article, and the reader who desires further details and some conventional analysis of vortex motion, can profitably read his article.

d. Northrup does not notice any secondary whirl formation. It is obvious that with his rapidly moving, very symmetrical whirls the fields would constantly be losing energy rapidly in a way that theoretically would make them give off secondaries *into* the filaments (§101g), and because of the well-balanced conditions such secondaries would tend to be small. Also, as the primary field in Northrup's whirls contained more or less of a fluid in which were chemicals that destroyed the coloring of the filament fluid when the two were mixed, it follows that as soon as a field secondary was projected into the filament a number of reactions are possible which would result in a perceptibly visible uneven distribution of coloring in the filament; which reaction would happen is a quantitative matter not determinable from the data given. Northrup repeatedly noted such a result, and it appears clearly in a number of his photographs as a collection of darker colored little roundish objects all along the filiar axis of the filament. Northrup couldn't account for them—said they might be dirt.

e. Northrup (in his photograph marked View D) shows two whirls made approximately at the same time and traveling side by side. Each whirl shows a field confirming our Fig. 98n; but on account of the rapid motion of the whirls there is some perceptible trailing of the fields (cf. §101e). One of these whirls looks precisely like the picture of an average comet (we shall see that comets are whirls; §120). The two whirls, by the usual Bernoulli's principle, have a sideways attraction for each other—shown by their tilting their main axes and approaching towards each other.

f. He pictures the same two whirls actually joining together to form one whirl (his View F). Later pictures given of the new whirl show its vibration in three dimensions; i. e., its filament bends very considerably backwards and forwards and in and out in rapid succession. —— The mechanics of those reactions can be got by applying Bernoulli's principle: or see Northrup's article. Those details are not explicitly needed by the general reader.

g. Northrup shows how whirls bounce off surfaces, producing marked vibrations, with the following phenomena:- They are reflected from surfaces just as light is reflected. They will break up diffusely (not visibly as secondaries) if the collisions are too violent. They will push aside relatively light obstacles. If the obstacle is relatively small and too firmly fixed to be pushed out of the way, the whirl will engulf it and travel right on around and past it without being broken up as a whole: analogous reactions happen (XIV, XIII) when electricity, light, electrons, etc., go through or pass over atoms or any structure of different order without being changed in *whole structure*. —— All those reactions may be followed in detail by applying the mechanics above. We see them in direct detail in various phenomena below.

h. Kerosine is less dense than water (it will float). Northrup shows that a water whirl, on passing into a layer of kerosine floating on the water, quickly drops the water out of itself, and forms itself of kerosine. That oil whirl may then be deflected back into the water, and will travel in it still made of oil. That is direct proof of the law that mass varies with velocity and-or Bernoulli's theorem. Even more definite proof is obtainable:- For as the oil whirl wears out in water, drops of oil visibly segregate in the filament, becoming visibly *analogous to the ether cells* I have described, and travel around in the filament, outlining it, apparently in direct violation of so-called centrifugal force.

§103. a. As another summary of the mechanics of this chapter I shall give a rough statement of the mechanics of gravity. (An ultimately precise statement of the mechanics of gravity is formally given in §134j.) In Fig. 103a let S be a collection of ether whirls which is the sun, and E a collection which is the earth. Then, speaking roughly, the relative motion of the earth about the sun is equivalent to a flow of ether between them, if we consider them fixed. Or, the result is the same as if there were a pipe, represented by the dotted lines, with the earth and sun contracting the flow of ether as shown. Hence, by the mechanics of this chapter there would be a lower pressure of the ether fluid against E and S in the space *between* them. As the ether is indefinitely extensive, and the dotted lines of the pipe are merely formal surfaces with equal pressure on each side, then that less pressure between S and E is equivalent to attraction. That attraction is gravity.

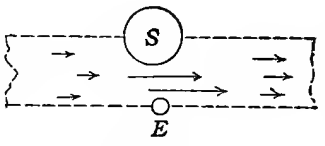


Fig. 103a.

b. That is the total of *conventional* gravity. For actual gravity we have to be somewhat more precise, and not stop thus with E and S tacitly rigid One bodies, and with the explanation concealing a considerable collection of zeros and infinities. In short, I have tacitly expressed *That...*$\times$*This...* by $S \times E$ (without dots); to be consistent, and reasonably accurate, we need to include dots. But when we do, *gravity* is no longer separable from other phenomena (§134j).

c. That inclusion of dots is accomplished by definitely considering the actual fact, that if E and S were (1) regarded as simply two cells they would still in that elementary form be elastic, so that the difference of pressure at the contraction would modify their size and hence in infinite regress modify the resulting contraction and hence the "force" of gravity. Or, (2) if E and S were actual collections of whirls, then each would have what we shall see is a field (§114f); and those two fields would react on each other, and theoretically be or give precisely the same modifications as in (1), in infinite regress. —— And the observed facts are that E and S do have magnetic fields, and that the pull of gravity is

not absolutely steady or static (not exactly according to the inverse square law; IX). Therefore, both by direct theory and direct observation, there is some gravity attraction between E and S and some chemical (or electrical, or 'field,' or whatever it is preferred to call it) attraction or union between them. And obviously, it is impossible to say that there is a real distinction between the two "sorts" of attraction (explicitly, the attractions are in infinite regress); each is what we call irrational if asserted alone. Hence, we rigorously have $W...\times A...$ (§74), or inexplicitly, $S...\times E....$ Or, the problem of any two actual or experimental bodies is insoluble (§83). Or, there is no exact science.

§104. a. In this section I shall directly unify the foregoing mechanics with conventional mathematical science, and with the measuring theory in IX. That is the sum of the book from a particular point of view, and so I have to condense; the section can become obvious in detail only to those readers who follow out the thought from the hints given. This aspect of the subject is so extensive that I have followed the suggested steps only a little way in preparing for this book, and had to write a volume or two to express that much. The general reader has perhaps forgotten what he read in his physics textbooks so thoroughly that he will have slight interest in, or recognition of, what is here condensed to dry bones. If so, a casual, careless reading will give him the essentials and be less boring.

b. We have seen (§§80h, 82) that any "perfect" part of the universe (such as *pv=Constant*) is symbolized by a rectangular hyperbola. For instance, if in the actual total

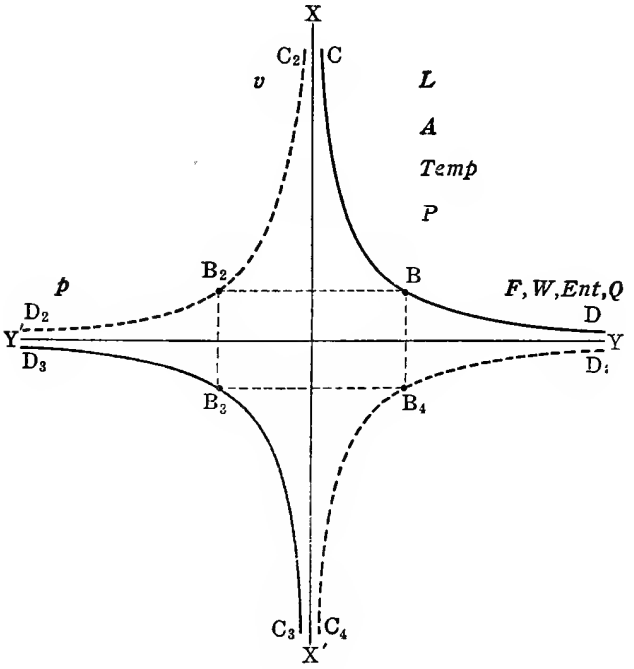


Fig. 104b.

universe the sun and earth were an absolutely separable perfect gas part, then $S\times E$ (without dots; §103b) would be represented in Fig 104b by the rectangular hyperbola CBD (including the third quadrant branch $C_3B_3D_3$) in which the general point B represents S *and* E. Clearly therefore, in order that the geometrical hyperbola may *accurately* represent bodies, the bodies must, as a truism, be reduced to geometrical point masses, of which there would be an infinity, so that the universe would be validly represented by an infinity of such hyperbolas, and infinite pluralism would formally be considered reality. In that case it is obvious that the *only* way to represent *any* phenomenon with logical consistency would be to travel on the hyperbola representing conditions at the beginning of the phenomenon to the asymptotes (i. e., revert to monism, or mystic $0-\infty$), and *shift on those* to the hyperbola or hyperbolas of *the conditions resulting* (and for intermediate steps of the phenomenon an indefinite number of those curves would have to be considered similarly used). —— Now, if Carnot's perfect heat engine, or any perfect gas, or Newton's gravity, or *any* absolute constants, or any exact cycles be asserted, obviously such a geometrical representation of them *is* consistent and valid. *But*, it is equally obvious that such a representation is actually an ad infinitum affair or regress, and *in so far as it is explicit* is mystic or religious language; it formally and largely explicitly is the old Maxwell science and is also identical with the metaphysics of Hegel, which I understand he admitted was unintelligible to himself; it is obviously mystic language which is the opposite of Many language and to the usual *tacit* valid logic and commonsense used by science. I. e., every one of the bodies B is in every *explicit* expression (every actual curve) a perfect universe *of itself*. In metaphysical terms, each perfect curve is Kant's "thing in itself"—and most other older dualistic philosophers had a pet name for it. Maxwell's pet name for it was *molecule* or *atom*; that infinite collection of hyperbolas is equivalent to Maxwell's kinetic theory (except that I am finishing it here); for clearly, the actual working together of the parts of the total universe is *merely implied*—the describer of phenomena reverted to One language (went into a verbal trance, so to speak) and said God worked them—moving in a mysterious way his wonders to perform. It is quite true; the universe did do them: but science proposes to say *positively* how it did. Obviously, so far as positive explicit expression of phenomena is concerned, that old kinetic theory—and similarly all dualism, including classical logic and orthodox theology—makes no statement whatever of *how* or *why* or *where* such a universe or God works. Or what amounts to identically the same thing, it is glaringly obvious that those old doctrines provided no structure, no real mechanism, no actual relationship (such as love), no working together, no binding together which *is* religion—provided none of that in any explicit way; but in geometric expression, left it all to the asymptotes at a 0-point at ∞. —— Well; as is obvious, such doctrines are right ultimately, provided we dig out their implications as was done for classic logic (§24). Unquestionably that tacit taking for granted of relationship is the entirely valid religion which animals, etc., correctly hold; I remember that as a child I took such a tacit religion for granted and wondered why people invented a God when all things worked beautifully and justly right before their eyes. The only valid objection that can be made to those dualistic, perfectly kinetic, orthodox theological doctrines is that they merely fail actually and positively to use the language tool; they stop before they finish and then get into a stew because their God is as empty as those asymptotes. Such doctrines obviously pretend or seem to use language, whereas in actual effect they are using formless interjections, like the clucks of a hen.

c. But if we use as B any actual body (a finite Many part of our usual Trinity language), then the body does not stay on the perfect hyperbola. If we use Van der Waals's partially corrected equation, which is a cubic equation, the body takes a *swerve* at some place (Daniell's "Physics," 376) and the body apparently usually has two imaginary values (see par. i). Richards's form of the equation, or our *That...* $\times$*This...*, or the $S...\times E...$ of the last section, obviously makes the hyperbola become a *continuously changing line* of infinite length, which is the single closed line we saw representing the universe in §98m. Hence, any phenomenon is

represented by an actual portion of that universe line. But no phenomenon can be accurately described; only by summing it into the One do we get accuracy, and then it is formal and mystic and sums as being the asymptotes, which directly represent the One.

d. Also, although I shall not go into it explicitly, this hyperbola model is being given in two dimensions, with the third only implied. We must add the third, and consider 3-dimension curves in order to be completely explicit. This modification applies to this whole section.

e. If a symmetrical single surface ring of no thickness and infinite width be revolved, this hyperbola will always be related to the generatrix in ways suggesting mathematical laws, including the inverse square law—and also the non-Euclidian geometries (by having the generatrix vary from a straight line) and *n*-dimension space (by extending or 'duplicating' the curve beyond the point where it touches the asymptotes—as in orthodox projective geometry).

f. Suppose we take a formally infinite or One filament (as in §100df) in which the surface is a geometrical surface of zero or infinite velocity. Then suppose we change the filament so that it comes just inside those One limits, its values becoming finite. Then the motion in its surface becomes helical with pitch angle different from 0° or 90°, but approximately one or the other. Then a line of no force would be normal to those spirals, and approximately in the surface (we may take it so, omitting considering its other dimensions). The projection of any such line on any plane through the main axis would be (approximately, by valid logic; exactly, by classic) our hyperbola—which is a line of no resistance. But that line is at right angles to the line of no resistance of §98m. So we see by this geometry how the inverse square law comes in. —— This paragraph is condensed far below the point tolerated by mathematical precision.

g. The last paragraph is another form by which par. b can be proved (and understood, if you have the patience and professional need to dig out the implicit truisms in the last paragraph). Incidentally, use of *explicit* logical expression in the last paragraph would make the One 'line' of no action definitely 3-dimensioned, so that the two 'lines' mentioned would be ultimately closed on themselves and identical.

h. Also, by explicitly and with pluralistic consistency shifting from that One filament to actual or finite ones, we get the actual universe line of par. c again. The hyperbola of par. f is obviously simply the *limit* or envelope of that actual line. So from that point of view all of Carnot's theory and of old kinetic and cyclic theory can be seen to be only *limiting* statements of actuality, and not actuality at all according to ordinary language. That covers the whole theory of calculus, and most of physical mathematics. *If* it be understood that each such dualistic or classic equation is summed *perfection* or absolute abstraction from our actual world, and hence (1) is actually inaccurate; and (2) is formally separated from all others, so that logically *explicitly* there can not possibly be any such thing as what is actually meant by explanation, or knowledge, or continuity—if that be understood or implicitly accepted, then even the mathematics of Maxwell is correct. And science nowadays does implicitly accept those things, as shown in the next paragraph.

i. As noticed (par. c), Van der Waals's equation makes a swerve (usually), giving two imaginary roots. Obviously, therefore, those imaginary or logically absurd values result when the *actual* observed curve, by everyday language leaves that One hyperbolic curve and exhibits at least two of the actual dots of $S...\times E...$ or $p...\times v...$—and hence does contradict the classic logic it started with. So it is further truistic that the swerve in Van der Waals's curve is equivalent to the inverse square law (cf. pars. e-g), or to the principle of Ampere's law. And Van der Waals himself substantially asserts that, when he says that the modification of the exact *pv* is due to a *variable* extension or "field" of the bodies—which are molecules ("Ency. Brit.," vi, 846). Richards's theory makes all that explicit. —— Therefore, vaporization or melting or disassociation (etc., in infinite regress) lines in *pv* curves (or in *any* curve of the general *That*...× *This*...) are actually the verbal inverse square law; or explicitly represent (never accurately) the 3-dimension difference surfaces of field and-or filament. Or, they are the explicit geometrical model (or equational) representation of the formation of whirls of a different order (cf. Reeve's "Energy"). Or, Van der Waals's "imaginary states" merely mean that the *M*'s talked of become something else, that are not of the same order or "state."

j. The last thing to be definitely suggested about this sort of averaged or summed or $_e$ form of model of the universe, is that it shows that we may reverse the *direction* of naming of any quantity—i. e., that our location of the zero potential of any phenomenon is purely arbitrary. Ordinarily we fancy—without really thinking—that we name things which would be represented in the first (trigonometric) quadrant as algebraically positive, and that all potentials are taken so that such positive trigonometrical directions increase them numerically. But it may be readily seen that even science, with its more careful speech, does not thus consistently name potentials:- Ordinarily, with reference to molar bodies, the extensive factors *F*, *W*, *Ent*, and *Q*, and their respectively corresponding intensive factors *L*, *A*, *Temp*, and *P*, are named positively, as indicated in Fig. 104b. But *p* is a force which usually is named as acting oppositely to *F*; so a conventionally positive *p* is in the direction of OY′, and $p...\times v...$ is in the *second* quadrant—giving the conjugate hyperbola, or a language from a different viewpoint. —— Also, when conventional science shifts from molar translatory motion to vibrations the point of view changes from *out* to *in* (or vice versa, if you prefer to look at it that way), and the direction-naming shifts from the usual branch in the first quadrant to the branch in the third. Hence, when Reynolds substantially begins by considering vibrations as real or positive sort of motion his whole nomenclature of *molar* bodies practically reverses from custom. But his vibratory motions are consistent with the customary naming of vibratory directions, because conventional science is capsized in its language referring to them. —— Therefore, here in brief is the general theory of potential directions. I omit the several volumes needed to treat the matter adequately.

k. So this section is a summary of the mathematical aspect of the *That*...×*This*... member; it becomes *naming* mathematics, or "geometry." (Obviously, it is a general repetition of IX, which gave the "algebraic" mathematics of the measuring member.) I have merely very roughly suggested its possibilities. I have not gone far enough into them to be very definite about them; but the mathematical physicists will have no difficulty in seeing that even this elementary discussion unifies their equations. There is no further mathematical discussion in this book beyond occasional brief reference; this section is not actually mathematical, but only implies mathematics—as does the phrase "Good morning." Such a large proportion of all orthodox mathematics is infected with classic logic that it is a sort of necessary evil that we have to endure, to refer to such mathematics at all. The reason ordinary mathematics are so excessively boresome and offensive is that they are so wrong and meaningless (cf. §30g). Consequently, they are not a pleasant topic for discussion, just as bad health is not usually a pleasing

subject. Hereafter, I mostly use the *That...×This...* directly—usually as the explicit machine *Field...×Filament...*, or some duplication of it, as *Those whirls or cells...×These...*.

CHAPTER XII. *Astronomy.*

§105. a. It was shown in general in §100 (especially in pars. bc) that the practical way we had of using the form *That...×This...* was to split the universe into parts on the criterion V_1. Parts of our skin (including our eyes, which are physiologically parts of the skin; "Ency. Brit.," x, 93) are used as standard parts; and that fixes all other parts with quantitatively a corresponding variation of limits (because the skin itself is variable). That actual standard makes atoms the primary order of whirls, as atoms are the skin structures, with a velocity V_1 of difference surface (see XIII), so that other different-order structures have different, but proportionally related, velocities. All "things" in the universe are therefore in practice compared with that standard or 'primary'; e. g., our nervous activity or "thought" is (in this "materialistic"-seeming phraseology) *directly* such atoms (XVII). The first "higher" or superorder of bodies is molar bodies—such as the skin itself, or any arbitrary part of it, as the eyes or nervous system; or such as a house, a man, the earth, the sun. Conventional science gets from the atomic order to the first super- or molar order by means of the kinetic theory—by making the atoms dynamically fly around in 3-dimension space in order to produce a static molar body. And conventional science, in full agreement with the logic of this paragraph, finds that if the *whole* of a body has V_1, its mass theoretically becomes infinite. I. e., the old Maxwell kinetic science has *just two* actual orders of structure; the experimental introduction of the electron, which is the first infraorder, thus promptly threw that theory into mysticism.

b. We have seen that such a passing from one order to another order logically implied an infinity of orders. Modern orthodox science is in logical agreement with that. We have made a verbal form or machine in which by using the inverse square law we make the step from order to order. (And this is an important point:- because the conventional kinetic theory is logically *one* such step, it is clear that that theory is nothing but a verbal form which *definitely implies* that inverse square in a negative fashion in its fundamental formula, $\frac{1}{2}mv^2$.) And we have also devised a "concrete" machine by which definitely objectively to make the step:- a whirl, or any of the indefinite number of machines to which it is equivalent. The old Maxwell dualistic kinetic theory is not a machine at all, but a poetic adumbration of a machine.

c. Therefore, we combine molar bodies into a next higher order, and get a solar system. The combination of solar systems into a higher order gives a stellar galaxy. And a combination of stellar galaxies gives a higher order for which there is no conventional name, but which becomes definitely identical with combinations of atoms into various molar bodies. Etc. —— According to such naming, molecules are molar bodies. The final truth is that those "orders" are not sharply distinct from each other (§§101j, 40); so I deliberately leave out molecules as an order, to emphasize that. A molecule is a transition stage from atomic order to molar order—sometimes a large atom and sometimes a small molar body. There is no such thing as a fixed "element" or absolute atom. All other orders have 'transition' stages: the inverse square law *never* names *actual* bodies perfectly. —— And proceeding in the other direction of orders from atoms, we get electrons, parts of electrons, etc., on "down" to cells. (Between atoms and electrons are various transition stages which are directly experimentally perceptible in radioactive phenomena.) It has been seen in principle that there is no essential difference between these orders—only a quantitative, or L and T one. We are now ready to see, by directly observing the various orders, that they are essentially identical. By doing that we get some useful results. Those results are roughly anticipated in the remainder of this section, so that the reader may know what to be looking for.

d. By observing the various orders of whirls, and seeing that they are qualitatively equal or identical, but truistically never quantitatively equal, we shall get a rigorous, intelligible proof and knowledge that men, as well as other things, are qualitatively identical and equal, but never quantitatively equal. I. e., it is absolutely impossible, and practically and theoretically irrational, to average men or anything else into FIXED *classes*. All of classic logic, orthodox theology, socialism, all the Maxwell kinetic pseudo-science try to assert the dualism that men are fixed in classes—that some are *intrinsically* "better" than others. They all try to impose upon men hierarchies, autocracy, socialism, or some other sort of "line" or bureaucratic rule like the German in 1914 or the papacy, in opposition to democracy (XIX). We shall see that all those conventional dualisms are irrational by seeing that in the whole universe there does not and can not exist any essential or qualitative distinction in order—no fixed classes—no exact science. On the other hand, *quantitatively* no two men, no two atoms, no two of any actual things are ever equal (i. e., in size, or measure, or amount, or *practical* or Many *needs* or *worth*. —— I stated above that orthodox theologies arranged men in classes. As the truth of that may not be immediately obvious, I state it explicity:- So far as I can find, all those theologies technically assert that their God, or each of their Gods, is a person who is superior to, or essentially better than, other persons or men. That truistically gives at least two fixed (or "line" or military or bureaucratic or aristocratic) classes:- (1) men; (2) God. And that is irrational. This book demonstrates that man *is* God—that God or the universe is *quantitatively* different from any given man as conventionally specified (i. e., 'skin-bounded'), but that God is in no essentials different.

e. We can see the solar system, comets, etc., in more detail than we can see atoms. A comet, e. g., as is shown, is an electron of the solar-system-considered-an-atom. So from several points of view we may learn more about atoms by observing the solar system, etc., than by observing atoms.

f. Also, as we have a consistent mechanics, we may, by investigating such "higher" order whirls that are easy to see directly, get a thorough base for human phenomena—"life" becomes easily comprehensible (XVI).

§106. a. Therefore, because it makes no essential difference what order of whirls we use as a means of acquiring a full understanding of our immediate environment, we may without inconsistency employ such whirls as give us direct quantitative details. The so-called astronomical or celestial whirls seem to do that best to begin with. Those whirls exhibit all phenomena directly, as we shall see. But I arbitrarily reserve light, electricity, etc., for other chapters.

b. Many of the quantitative details which we observe have not yet been measured very definitely. So it is obvious that I shall have to make rough guesses at some we need. It is inevitable that there must be quantitative inaccuracy in my description; but it is most probable that that inaccuracy exists in such a degree that some important and useful phenomena are made vague. I can hope only to be logically consistent.

c. It may seem at first thought that there is no need to guess at anything—that such guessing is not science. The general reply to that is obviously that there can not be any exact science (§40). The practical reply to it is that we are forced, as a means of continuing to live at all, to guess at the characters or "properties"—measures—of the people and things about us. Every time we eat anything we in effect guess at the motives and properties and attributes of the persons who were perceptibly concerned in the production of it—e. g., as to whether they wished to poison us. The incomplete physics or other sciences and theologies in textbooks furnish us with no definite or consistently expressed basis or criterion for making such guesses. We have been going through life without any consistent conscious basis of estimating or judging or guessing at the majority of the important decisions which we actually do make. The universe or God takes care of us, by it as a whole causing us to make fairly correct guesses intuitively (i. e., with very vague consciousness—as we are a part of the universe)—which fact is more or less contrary to the hoary, conceited myth that man is a reasoning (i. e., conscious) animal: for only in small part is he conscious in the sense that he thinks or is intelligent. We see the proof of that in Part Three—and how man pays for such care by the loss of possible conscious life in some degree. At present it may be noted that we do some consistent guessing at astronomical quantities as a means of becoming conscious of a consistent basis of making everyday judgments. The more conscious we are of what we are doing the more life we are aware of having; e. g., if we are asleep we are unconscious and not aware of having any life. Hence, as real science can do nothing else but guess, it is honest to admit it, and then proceed consciously to guess. That does not mean that I am rashly abandoning observations and measures; actually, I am doing much less guessing than does an astronomer who doesn't know the principles.

§107. a. Astronomers seem to agree rather generally that our stellar galaxy is a *nebula*; see Hink's "Astronomy," Arrhenius's "Destiny of the Stars," etc. "The Encyclopaedia Brittanica" (xix, 332) gives eight arbitrary kinds of nebulas, depending on their general appearance:- (1) irregular nebulas, (2) annular, (3) double, (4) planetary, (5) elliptical, (6) spiral, (7) nebulous stars, (8) diffused nebulosities. We shall see that nebulas may consistently be considered to be whirls. In that case those descriptive names correctly describe whirls seen from various points of view, and in various stages of growth or of wearing out. E. g., an irregular nebula, of which the great nebula in Orion is a type ("Ency. Brit.," Art. "Nebula," Plate I) looks very much like a newly formed whirl, with its visible field, in a rather disturbed condition; an annular whirl looks like a filament, seen normally; a spiral nebula looks like a filament that has become comparatively stationary as regards traveling in the direction of its main axis, and has given off a number of secondary whirls which hence traveled spirally roughly in the filiar plane (instead of revolving about the filiar axis as in Fig. 98w). We see more such details as we proceed.

b. There is no definite agreement among astronomers as to what sort of nebula our stellar galaxy is. As we shall see, it probably is a rather flattened-out whirl, so that quite likely it has the spiral appearance if viewed from a neighboring nebula (§108b). However, our solar system is probably comparatively near the center of such a spiral, even though we are not (except in the direction of the Milky Way) perceptibly surrounded by nebulosity. I. e., our galaxy is probably shaped like a large double convex lens—or like a grindstone, to use another conventional simile. That is experimentally shown chiefly by the observed distribution of stars, the appearance of the Milky Way surrounding us as a ring, and by other details mentioned later. In Fig. 107e, DA and BC are cross-sections of a conventionalized or smoothed-out Milky Way or filament. We are near the center, at S, and around us we see that filament. It probably is smashed somewhat flat by surrounding whirls or galaxy-nebulas of the same order, so that it (the filament or Milky Way) has but comparatively slight motion of translation along the main axis PP′ (say as a guess 100 miles per second, which is very slow for such a whirl), and hence has comparatively more motion of rotation about that axis (resulting in a spiral motion in the field, not shown in the figure). Our solar system S is in the inner field of the whirl, a little above the filiar plane (for clearness, the figure probably much exaggerates its actual distance above), in a dynamic equilibrium with that field—which inclines the ecliptic somewhat to the filiar plane (the ecliptic is the rough plane in which the earth revolves about the sun and which the other planets more or less stay close to; that is not quite the strictly technical definition, "Ency. Brit.," "Ecliptic"; the inclined *axis of the ecliptic* is roughly NS′), and which equilibrium also involves the revolution of the whole solar system about the *stellar main axis* PP′, as we shall see.

c. Our galaxy is equivalent to an atom in everything but size (*and T*), and that is unessential. It is obviously surrounded by other stellar galaxies. I do not know whether those galactic atoms constitute a 'celestial' gas, or liquid, or solid (perhaps a solid; see par. g). We probably can not see farther than a very few layers of such surrounding atoms: light itself is absorbed by those surroundings (§§131-2), so that *comparatively* speaking we are probably in the same kind of darkness that *we* would say existed in the center of a lump of coal (although there would be light there to the parts of coal atoms). Even if our galaxy were an atom of a celestial gas we would have comparatively short vision of surrounding atoms (XIII).

d. In technical astronomy the usual unit measure of stellar distance is now a parsec, which is the distance at which the orbit of the earth subtends an angle of 1 second—i. e., gives a "fixed" star a parallax of 1″. It is equal to about 206,000 "astronomical units." An astronomical unit is the average radius of the earth's orbit, which is about 93,000,000 miles. An older measure of stellar distance is the *light year*, or the distance which light at V_1 travels in a year. It is equal to about $\frac{1}{3}$ parsec, or to about 6 trillion miles. I use light years, as that is more familiar.

e. There are no agreed upon figures for the size of our galaxy. Eddington ("Stellar Movements," 225) roughly guesses that the distance apart of the inner surfaces of the Milky Way (the diameter of the hole in the 'doughnut'; or the distance from A to B, Fig. 107e; see par. b for preliminary description of this figure) is about 700 light years. Other men guess considerably higher and also lower. I shall to some extent use Eddington's guess as a base (although it probably is considerably too small), making other figures in proportion. The field of the galaxy in the figure has a difference surface with much inaccuracy represented by the outer dotted line (to save space, etc., one end of figure is cut away). That field probably has a long diameter of something like 20,000 light years, and a short diameter of something like 2000 light years (the diameter along its main axis PP′).

f. The Milky Way filament has an ether flow as indicated very roughly by the arrows. Hence, in so far as that flow is not balanced by a rotation of the whirl around PP′ and a spiral reaction of the whole whirl with adjacent whirls (due to the spiral flow of the field ether, which is not indicated in the figure), there will be a motion of translation of

the galaxy as a whole down, in the direction PP′, as was seen to occur in Fig. 98n (§101d). Although I do not show that spiral flow for the galaxy field in the figure, I show in rough perspective the general spiral translation of the solar *system* S (by the dotted line on which the various S's are): the motion down of the galaxy in the direction PP′ would actually be a similar corkscrew motion among the surrounding galaxies.

g. Astronomers observe motions of translation of nebulas which are apparently outside our galaxy to be as high as 600 or 700 miles a second. Several thousands of spiral nebulas are observed around us. The average motion of such nebulas is observed to be perhaps 250 miles per second; hence, our nebula possibly corkscrews down at about the same rate (but see par. a). There is not much reliability about such figures as yet; for nebulas are faint, and are difficult to measure even in photographs. But it is already obvious in part, and will become more so as we note more details, that such motions are very slow compared with the size of the objects. I. e., very little change in our galaxy *as a whole* is produced by that, to us, rapid motion. Such motions of translation are comparatively speaking almost static conditions; i. e., the collection of galaxy whirls in which ours is one atom would be, if those velocities are fairly good guesses, about as fixed and steady as atoms in what we call a solid. And that possibility that we are in a celestial solid is further strengthened by the fact that observed distances of other galaxy nebulas are roughly of the same order as the size of ours; i. e., the galaxy whirls about us are packed in as steady as the bricks in a wall—always speaking comparatively, of course (and in spite of the fact that it is conventional to hear of the "enormous" "waste" spaces in astronomical structures). I shall keep on speaking comparatively, and omit repeating the obvious and unimportant and unessential quantitative fact that a short astronomical distance is a long terrestrial one. We are customarily expected to marvel at astronomical figures—especially velocities. The truth is that to anyone with a fair judgment of proportion, astronomical velocities are comparatively slow. *From analogous points of view* it is just as difficult to detect the slow motion of the solar system as it is to detect the slow motion that is the growth of a plant. So it is to be hoped that the old-style popular writers on astronomy will stop tacitly inviting that we stand like rustics, with our provincial mouths ajar in wonder, whenever they mention a comparatively negligible number and tell us that it is marvelous and stupendous—for relatively it is nothing of the sort. The psychological effect on themselves is obvious.

§108. a. The last section gives in rough outline the description of our galaxy. All other astronomical structures, as well as atoms, etc., are of the same general nature at the youthful stage of their lives. Experimental evidence of the consistency of that description is given by the remainder of this chapter. There are such a number of things in the galaxy, and the changes in it are usually so nearly imperceptible to us, so slow are its movements, that the experimental observations and measures are rather unreliable. So we shall mostly use the solar system whirl instead of the galaxy.

b. Many astronomers are inclined to consider our galaxy as being a well-developed spiral nebula, with the solar system at S, as in Fig. 108b (the figure is adapted from Arrhenius's "Destiny of the Stars"; cf. p. 45ff). So far as I know, the galaxy may be considerably broken up, as indicated in that figure; but I am inclined to think that the Milky Way

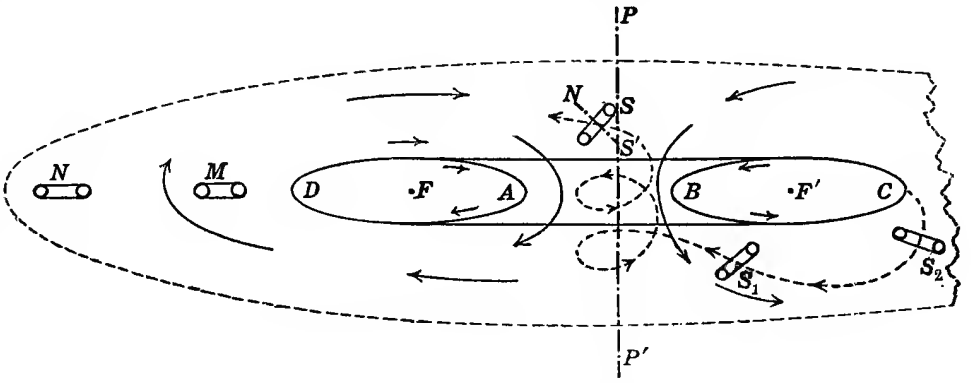


Fig. 107e.

directly appears to be so well-formed as to indicate the better preserved whirl of Fig. 107e. However, as that is not reliable proof, and as there are no other facts that I know of to decide the point, what I shall do is to describe our nebula (including details of the solar system) in a broad way—covering all the probabilities, which are innumerable. Then, if the astronomers by further and more complete observations of stars as they actually are, find our galaxy to be of the character shown in Fig. 108b, that will be a special case of our description. My personal guess at the quantitative character of our galaxy and solar system is that the galaxy is a rather regular spiral that tends towards being an annular nebula, with the solar system rather near the center, as shown in Fig. 107e, which I shall call a regular spiral or a whirl spiral. The spiral shown in Fig. 108b is more like a spiral that would result if two large bodies *or clusters* pulled each other apart by gravity, and I shall call that a gravity spiral. As we shall see in the next two paragraphs, there can not be essentially different sorts of spirals: the difference is quantitative, and each kind is partly the other kind.

Fig. 108b.

c. I may here briefly anticipate some conclusions, in order to state what are the two general kinds of nebulas into which I arbitrarily divide the eight sorts in §107a. If we had a nearly homogeneous fluid whirl, practically as our experimental whirls may be considered to be when first formed, or as an ether whirl containing only cells would be, then as we have seen, it would wear out or grow old by giving birth to lower order whirls, and those whirls would tend to collect into spherical "solids" like the earth. We shall see that in detail later. —— (1) During the process of wearing out, that fluid whirl, if rather closely surrounded by whirls of the same order, would be what was called a *regular* or *whirl spiral.* Or, some large secondary of the whirl, surrounded by other secondaries, would pass through the stages of such a rather regular whirl or spiral. Or, finally, if two rather fluid whirls combined (as in §102f), the resulting single whirl, if surrounded by others of the same order, would pass through the stages of a whirl spiral—as shown in one stage in Fig. 107e. —— But on the other hand, a whirl, which had

reversed or aged or "degenerated" into a spherical solid like the earth (with usually one or more solid satellites like the moon), might approach fairly close to another similar whirl. (That would be possible because the field of that solid would be comparatively weak, as we shall see. I do not think that such approach is often probable, but I do not know the quantitative chances: cf. the remainder of this chapter.) In that case the two solid whirls (never perfectly 'solid'—always there would be some sort of 'atmosphere' of satellites, etc.) would combine by pulling each other to pieces. Some of the pieces would probably stay rather "solid"; most of the pieces, for reasons which we shall see, would 'evaporate' into ether—i. e., break up into pieces as small as electrons, etc. The resulting single whirl would be what I call a *gravity spiral* nebula (because ordinary gravity was the major force producing the result). That whirl would become, more or less quickly, practically identical with a fairly aged fluid whirl. At some age of each sort of whirl or nebula they can not be distinguished apart. The differences occur in their youths. So the differences in the nebulas are quantitative differences of past history. That history determines the kind of spiral.

d. We could say that the rather fluid regular whirl is chiefly dynamic, and that the rather solid sphere is chiefly static, and we have the same quantitative distinction. As before, it obviously is not possible to have in any pluralism a perfect fluid, or a perfect solid. That is equivalent to what we saw in §80 concerning no perfect static or perfect dynamic phenomena: we see here in general that there can be no essentially different kinds of nebulas. And we shall see that that is equivalent to saying that there can neither be any gravity alone, nor chemical affinity alone; both act together in astronomical structures, sometimes one and sometimes the other temporarily having the greater effect (IX).

e. In a fluid or whirl spiral, in the stage pictured in Fig. 107e, chemical affinity has perhaps the greatest influence *with respect to the whole whirl.* Inside our solar system as it is now, gravity has the greater influence with reference to the larger bodies in it, or with respect to the whole whirl. —— As is now rather well known, the efficacy of gravity pull has in the past been considerably exaggerated. The orthodox nebular theory of Kant and Laplace ("Ency. Brit.," Art. "Nebular Theory") substantially makes gravity the whole (i. e., infinite) cause—which obviously is correct as religion, but is pure nonsense if claimed to be expression in pluralistic or scientific everyday language. —— Because gravity pull has been conventionally so much overemphasized I am here more or less forced to make a somewhat disproportionate amount of remarks about its completing factor, chemical affinity (or electric or magnetic forces, as they are more usually called in this connection). The reader will note that rhetorical result, needed temporarily now.

§109. a. We may briefly consider the general origin of the galaxy, although it will merely be a "concrete" repetition of the previous proofs (X, XI) that any splitting of the universe into parts implies, by our Trinity language, a structure. If we like, we may commence with a perfectly fluid ether universe—perfectly static or perfectly dynamic,—and existing as anything, or nothing, just as you please. If we consider it pluralistically split in any way, then by our usual language we introduce time and space as methods of naming the results, and the results are finally atoms, which by our human criterion have difference surfaces at V_1. Some particular order of those whirls in infinite regress would contain a particular whirl which is our galaxy. Its existence implies us, with our V_1 criterion; and our existence with that criterion implies that whirl. Like the chicken and the egg, neither comes "first," except by purely arbitrary agreement as to what is precisely quantitatively a chicken, and what an egg; and that agreement can not be made *exactly* in a finite number of words. So ultimately the chicken and the egg are identically the same (and we and the galaxy are identically the same), and are the universe. Like Topsy in "Uncle Tom's Cabin," the galaxy whirl 'just grew.' This paragraph consistently states what *grew ultimately* means (§35f).

b. Topsy was expected to state her immediate parents —to talk in finite, Many terms. So we too may drop that tacit infinite time of the last paragraph, and undertake to state the finite origin or parentage of our galaxy whirl. I am unable to find any observed data which will give that parentage. Or, the whirl may not have had 'parentage,' but may be the result of a marriage or joining of two large spherical 'solids' (those 'solids,' with their satellites, are usually called star clusters or systems) which had previously been born perhaps. I. e., our galaxy whirl (1) may be a secondary of some larger whirl (an electron of that larger atom); or it (2) may be that (A) two large suns, or (B) two clusters that were not so far condensed into mostly only two such suns, or (C) two more fluid whirls, united to make it.

c. Both those general possibilities could produce our galaxy whirl. Obviously, our machine is in principle perfectly reversible—going equally well "down" or "up" in order of whirls. All we need to note is that whatever the actual origin was, the primary whirl that gave off the new secondary, or the old whirls which united to form a new one, was or were partly fluid and partly solid, so that there was at all times no perfect characteristic or property (no 'egg' that was essentially and absolutely egg and nothing else), and no absolute homogeneity or heterogeneity of any sort. (We shall see that those same processes apply precisely to the birth of biological organisms; §146). —— It may be observed that this investigation of the origin of our galaxy is perfectly general in principle. Consequently, it will apply as the description of the origin of *any* structural part of the universe:- to a chicken and an egg, atoms, electrons, etc.; it will apply to (say) chairs, provided that the man and his tools and materials which produce the chairs are considered as partly joined together during a given time—as they *are.*

d. If we tentatively accept the guess in §107b that the galaxy and the solar system are both roughly whirl spirals, then a fairly reasonable guess as to the age of our galaxy would make it *as a minimum* a trillion of our years (10^{12} years; I use the American and French style of numeration); the solar system would as a reasonable *minimum* be a number of billion years old (say 50 billion), counting from its first rough splitting off from the Milky Way filament. However, both might be a million or more times older than that, as we see later. Possibly the astronomers may readily find data which will give more definite guesses at the ages. If the galaxy is a gravity spiral, then I am unable to find any reasonable basis for a guess, except that by geological observations the solar system must be a number of billion years old; as will implicitly appear, the galaxy must be older.

§110. a. We shall begin to get more explicit proof of the last two sections by considering the birth and history of the (our) solar system. Suppose we have the galaxy filament (the Milky Way) somewhat as shown in section in Fig. 107e. The difference surface would be continually subjected to varying velocities (equivalent to pushes and pulls) from inside and outside the filament—every phenomenon that happened in the universe would in time be registered thus on the galaxy difference surface. Any push and any pull would form a whirl in more or less completeness (§§101-2). Those whirls would form in harmonic sizes (or else be quickly destroyed or 'assimilated' by sizes which did have such proportionality):

see Index, "Harmonic periodicity." Consequently, the difference surface would continually form whirls of various sizes. The smallest made in considerable number would probably be the new-born forms of our atoms; those which were not in fairly good proportions would be destroyed, but in such disturbed conditions atomic weights would vary widely in several ways from our present weights. For reasons and facts we shall see, those atoms of a certain atomic weight or size *there*, would, if it were possible to transport them to our laboratories without changing them, be considerably different from our analogous atoms in every property. I. e., C atoms there would not quantitatively be much like C atoms here; yet the collection of mutual L and T relationships possessed by the carbon atoms would, *relative to each appropriate location*, be practically measurably identical (not exactly identical; if exact identity be required, then the names of "elements" promptly require to become an infinity —as may be readily seen from the fact that *any* change in conditions changes the spectrum of any "element"; XIII).

b. The small or atomic whirls would have difference surfaces of a velocity which of itself gives visibility, or nearly so (proof:- we *see* the Milky Way; also, the rest of this book). That velocity would be of the same order as V_1 (it differs somewhat, as those atoms are not in an environment like our neighborhood; cf. XIII). The atoms would also in most circumstances be visible by diffusing, reflecting, etc., light that came from atoms in other places that had light-giving difference surfaces. The Milky Way atoms might locally be in sufficiently dense and extensive clouds of themselves to become dark, if their difference surfaces were not at a visible velocity. But obviously, without going into the lengthy details which are implied in XIII on light, we may take a short cut to the conclusion, and see that the chances are that usually there will be enough visible atoms about the Milky Way surface (or the difference surface of any galaxy *in our neighborhood*, or any large whirl in those whirls) to make the outline of that surface visible to us. We see more of the details and proof of that under zodiacal light (§121), and in §111 and XIII. What we particularly need to get at now is the meaning of the "temperature" of those whirls that are new-born at the galaxy difference surface.

c. Those new atoms (and other whirls) would have plenty of room—they could not be rubbing each other hard, but would have well-formed (newly-formed or young) filaments, and comparatively extensive fields. If we could stick an ordinary thermometer among them, its expansive substance would almost certainly freeze. For the "temperature" of the "gas" which those atoms ordinarily form is almost "absolute zero" in spite of the fact that they are glowing—"glowing hot." The temperature of the *ether which is the difference surface of the atoms* is "high"—for its velocity is near V_1 (if we could get our whole thermometer *in* that *surface zone* of ether, it theoretically would indicate nearly an "infinite" temperature: any actual thermometer in the usual sense would explode into electrons and smaller pieces). But that ether is obviously very small in amount compared with the 'insulating' slower ether of the fields. Our thermometer would come into contact with the comparatively very slow difference surface of the fields, and there would be nothing in the rather free environment near the galaxy difference surface to 'smash' that high-velocity ether close up to the atoms of our ordinary thermometer and hence the "temperature" would register low. There would be some radiant heat; but radiant heat in quantities sufficient to affect the thermometer very perceptibly can come only from a collection of considerably smashed together atoms. —— In brief, to sum up what has been said, the entropy of those atoms is nearly zero (by *our* standards) and consequently one of our thermometers, which requires an average entropy of *our* environment before it will register an average temperature, simply would register almost no temperature *of the whole gas*. (As a matter of fact, for reasons later implied, the ordinary thermometer will itself most probably begin to break up radioactively in such an environment. And precisely the same low temperature will be registered when atoms are very strongly pressed together, with high entropy, as inside the earth; it is the opposite aspect of the wide departure from the average conditions we use as a standard; cf. §§122, 120.) If we devise some method of forcing some of that difference surface ether that is at a "temperature" of nearly "infinity" close up to the atoms of the expansive substance of our thermometer, those atoms will locally radioactively explode, as implied above—and the exploded atoms will then tend again to have a temperature, relative to the original thermometer, of nearly zero.

d. We are so accustomed to judging heat anthropocentrically that it is difficult at first even to understand the last paragraph, which (except for the 'old heat' inside the earth) describes 'young heat' instead of our everyday 'middle-aged heat.' But it can be seen at once that the paragraph is a concrete summary of the theory of heat in §§78-81. As we see additional details of heat below, the last paragraph will become more intelligible. All we need to grasp now is the general fact that temperature is an intensive factor (which means roughly that if we want "high" temperature, we must get high-speed ether *at* the spot where there is to be such temperature), and entropy is the extensive factor of heat (which means roughly that there must be an *amount* of ether which will both build up a properly supporting structure about that point and also maintain the flow to it).

e. I have described atomic whirls as being secondaries of the galaxy whirl. There may be such a relationship of periodic sizes that the galaxy difference surface can not give off such comparatively minute whirls directly as secondaries, but must in the *ordinary* course of quantitative events give off large secondaries of (say) the order of the solar system, and then have them give off atoms as tertiaries of the galaxy. Or in the same way atoms may be an even lower order of whirl with reference to the galaxy as a primary. If so, it is merely a step by step quantitative process, which makes no essential difference in the brief description we need. For rhetorical simplicity I shall make the experimentally unguided guess that the galaxy difference surface gives off secondaries that range in size from electrons and atoms to solar system whirls: that is valid in principle (§101h-j). If it is not quantitative fact at a given time, then future closer observation of details and investigation of mechanical size-relationships will show what is so at a given time. But even then, atoms would be formed *near* (not *in* or *of*—as stated above) the Milky Way surface; and the actual phenomena and subsequent description would be quantitatively about the same as that I give, and logically identical. —— The same general remarks as to the order of whirls will apply usually to my description of them. In short, I can not get enough data to make a reasonably accurate guess as to *how many* generations there are *usually* between galaxy and (say) electrons. It is precisely the same as being unable to guess how many generations there were between Darwin and a given one-celled ancestor of his; the actual facts are that by following different lines of intermarrying ancestors there nearly surely would result *different numbers* of generations; and also there is no accepted arbitrary agreement as to what does constitute one generation of one-celled organisms. But obviously, with electrons and with Darwin, the essential thing is that there

are generations and changes of order or "species," even though the numbers or measures vary with the point of view. So it is obvious that in the description of all phenomena I give, infinite variation of quantitative detail is possible, and does occur in varying conditions: there is no exact science.

§111. a. Thus we have the galaxy difference surface outlined by atoms. That result happens only when that surface is in fairly stable equilibrium. If there were rapid changes in the galaxy whirl as a whole, that outlining would disappear. Our galaxy may move about 250 mi/sec (§107g) —and that, though slow, seems to be enough to cause the galaxy field difference surface to clear itself pretty much of secondaries of all sorts, so that the outer field surface is not appreciably outlined (cf. §112a). The same thing has happened to most of the solar system; i. e., its difference surfaces are nearly imperceptible, except what are now the main difference surfaces of it, such as the surfaces of the sun, planets, etc., as we shall see. Below we see enough details to make those galaxy phenomena clear.

b. And thus the galaxy filament surface continually gave off secondaries into and out of the filament (it still is doing so). We may guess that about 50 billion years ago there was from some cause a knock, or addition of energy, given to the galaxy field, so that a whirl which was to form the solar system was pushed out of the filament at C, Fig. 107e. That unbalanced knock, which was almost negligible compared with the size or energy of the galaxy, reached its fair equilibrium, or was balanced, by the birth of that secondary, the solar whirl, according to the mechanics given for Fig. 98w and in §101e. For several reasons which we shall see, the solar system *virtually lived faster* than the galaxy; also, we can observe it better. Hence, I shall discuss its general history, and thus imply the further detailed description of the galaxy whirl.

c. As a reasonable guess the solar whirl would be at least several centuries a-borning, and would, as a fairly symmetrical whirl like our soapy water whirls, *start* traveling out from C to the right (more or less in or parallel to the galaxy filiar plane) into and through the outer field of the galaxy at a speed of say 300 to 400 miles per second—probably more. This solar whirl would contain in its field ether a lot of glowing atoms, and also quite probably a considerable number of what we may call condensations (§114)—or more explicitly, planetesimal condensations. Also, it would be born into a disturbed environment; its very birth was due to asymmetries or lacks of equilibrium which locally were comparatively marked. Hence, the solar whirl at once began to form secondaries and wear out (i. e., "live") much more rapidly than the larger galaxy whirl had in general been doing, or does now. The galaxy whirl is apparently still virtually rather young, while the solar system is virtually middle-aged. In the periodic table (App. B) column 0 (He, Ne, A, etc.) are virtually young atoms; column VIII (Fe, Co, Ni, etc.), virtually old; and column IV (C, Si, etc.), middle-aged, and fairly stable like our earth, which is typically middle-aged, tending to elderly.

d. Before proceeding to follow the solar system from that guessed-at beginning, we may note the possible variations in its birth. In the first place, observation seems to indicate a thicker collection of solar systems in the center galaxy field where we are now, than outside (there may be a thick collection in the plane of the Milky Way outside, as at M, N, Fig. 107e: as we shall see, theoretically there is a tendency for such a collection to form, and astronomers with recently improved methods for measuring star distances are rapidly collecting data that will settle this and similar matters). If that apparently thicker collection in the center field is a fact, it then follows that the galaxy is moving rather steadily and is gaining in speed, so that usually the 'knocks' are negative and the solar whirls are now mostly born *into* the filament, where by rapid travel they remain virtually of the same density and are hence retained. A whirl born into the filament would encounter a spiral fluid motion of rotation and hence would revolve chiefly about the filiar axis, and with the galaxy filament would also revolve about the galaxy main axis PP′. That secondary in the Milky Way would itself revolve and rotate about its own axes, and proceed to condense into a solar system similar to our present one. Those solar systems would then interact, partly by affinity and partly by gravity. Those general interactions may be followed through in detail by analogy with what will be said of the solar system. We on earth are not yet appreciably affected by what happens inside the galaxy filament; we probably shall be so affected some day, as what happens there is likely to be the prelude to the Many end of this astronomical speck, the earth—as will implicitly appear.

e. And there could also be an indefinite number of variations as to the relative locality on the filament surface where the solar system was born. Birth at a different place would give quantitatively a different subsequent history—considerably different if the birth had occurred at say B, Fig. 107e, instead of at C. Qualitatively, the histories would be the same; *all* history must repeat itself qualitatively, as all principles are identical; but no history can repeat itself quantitatively exactly (all that being obvious truisms; Part One). So the history given according to the quantitative guesses I have made will implicitly contain all those unending variations (and those following from other possible origins of the solar system mentioned or implied later), and the interested reader may fairly easily work out as many of such variations as he likes from the following. —— The most probable place of birth of larger whirls would be on the outer side, as at C and D in the cross-section. That is so because obviously the field is least stable there: in all other places the field in greater degree supports itself more steadily. Consequently, any really large whirl would, as a mechanical truism, tend to be born on the outside. As we see in the next paragraph, the same mechanical principle will tend to produce spiral nebulas. However, the solar system is a comparatively small whirl; hence, there is no great probability that it was born at C unless it was born (as it may have been; cf. §112d) when the galaxy was quite young.

§112. a. The young solar whirl starts out to the right from C, as seen, and encounters a fairly vigorous upward ether flow in the galaxy field. Consequently (as was seen in §§98w, 101e), it rather soon (say in fifty centuries after it more or less appreciably finishes being born) perceptibly begins to move downward along the dotted path as shown in Fig. 107e. Now, if the field had not been relatively vigorous (and usually with a somewhat old whirl, or with respect to a large secondary instead of our rather small solar whirl, it relatively is not), then there would not have been enough fairly steady reaction to push (pull) the new-born whirl down along that dotted path. It would have kept in the galaxy filiar plane, with more or less wabbling or oscillation up and down with respect to that plane, depending on the minor asymmetries it encountered. Consequently, it would have steadied into some sort of fairly stable equilibrium while remaining more or less in the plane, as shown by the whirls M and N. Those whirls theoretically could be tilted in any direction, depending on local conditions, etc. —— There was in the difference surface from which they were born a component of rotation about the main axis PP′. The secondary whirl itself would *of its own internal energy* continue to

propel itself in that revolution about PP′ and for a considerable time if it were a large whirl; for it would take some time for enough asymmetries to accumulate to stop its motion in that direction and "head" it some other way. Also, as the secondary traveled out more or less in that galaxy filiar plane it would keep on 'spilling' its field (like a comet; §120) until it got into some reasonably steady equilibrium (cf. §111a). And all those results, with a field not relatively vigorous, would obviously produce the observed phenomena and appearances of a fluid spiral nebula—the large secondaries staying more or less in the filiar plane. The small secondaries would proceed as we shall see in the case of the solar whirl. (There would be whirls more or less on the dividing line between those 'small' and 'large' secondaries, which would produce a variety of intermediate phenomena.) —— Also, the large secondary whirls which produce the spirals would, in a considerable length of time (say some hundreds of billion years), condense, and they too would then fall out of that spiral (out of the orbit of revolution around PP′) and shoot around the galaxy filament as a comet (analogous to one of our comets; §120) on a path analogous to the one to be described for the solar system. So it will implicitly appear as we proceed that a spiral nebula, by whirl mechanics, will gradually turn into a star cluster. The star cluster, if let alone (if not too much knocked by an asymmetrical environment) until entropy piled up too high, would automatically break up (precisely a does a radioactive atom; §§139, 141) into a largely fluid whirl. Or, two clusters more or less colliding would produce a more or less fluid whirl of the gravity type. *The whole process will work in either direction from any stage*, and contains infinite possibilities. And, as perhaps is already obvious, there is in that process or life *never* any *comparatively* explosive or "quick" or "violent" action; *relatively* speaking, everything always works smoothly and rhythmically and without violence—which means that there is always easily visible continuity, or efficient cause, or least action. If we speak very carefully, anything that may be properly said to be violent or explosive refers to a comparison between different orders of whirls; if in such comparisons we explicitly include the inverse square, verbally even then no violence or catastrophe is apparent.

b. As the solar whirl traveled (Fig. 107e), the steadily changing direction of the galaxy field, as it flowed about the Milky Way, would force the solar whirl to change its direction into a revolution about that filament (about the galaxy filiar axis), as shown by the dotted path. The solar filament and field, by their own rotation about the *solar* filiar axis, would obviously keep the whirl moving ahead; i. e., *at first* the energy which makes the solar whirl travel as shown by the dotted line comes mostly from the solar whirl itself; the motion of the galaxy field at that time serves chiefly to *direct* its path (see par. g). Those fluid reactions are the same as those shown generally in §§98w, 101e, 107e.

c. Now, some unusual combination of circumstances may have caused the solar whirl S to move along practically *in the plane of the paper* through S_2 and S_1, as shown in the figure;—i. e., S might possibly have been given off with scarcely any revolution about the main axis PP′; only in one chance in infinity could there have been *zero* revolution (for a finite *time*, of course understood), which means not at all. But even if S did move so "simply," only by one chance in infinity could it keep on in such non-revolving motion. (Even if, as in par. a, a whirl wabbled back and forth in the plane of the galaxy filiar axis, without perceptibly revolving about *that* axis, it is but a temporary substantial non-revolution; for after a time definite revolution resulted, as shown. We are seeing an analogous thing here.) Consequently, S would sooner or later begin definitely to revolve about PP′. As a fact, S started out from C with a component of revolution about PP′, derived from the spiral in the galaxy filament surface. —— So as a necessary truism, (cf. §§98o, 101e, concerning spiral motion), S revolves about the main galaxy axis. In Fig. 107e the solar system's spiral path is roughly shown *in perspective*. That path is neither a perfect or geometrical spiral nor a similar helix, but is a combination of both which is forever varying as the galaxy field varies and as the internal processes of the solar system proceed, as may be readily deduced by Bernoulli's principle. Also, the rotation about PP′ might have been *in either direction*; it depends upon circumstances—perhaps usually chiefly upon birth conditions, although analogously to man, 'astronomical nurture' may under certain conditions take a chief role. [That revolution may be considered left-handed or counter-clockwise as viewed from above, and as drawn. Possibly that agrees, as it should, in relative direction with (1) the left-handed revolution of the planets, and (2) the arbitrarily drawn fluid motions in the figure, and (3) the naming of the poles of the earth's magnetic field, and (4) the usual direction of twist in the fiber of trees, the fact that man is usually right-handed, has his heart on the left side, etc. But I do not know; see §99b.] —— All of that is in direct agreement with the fact that the galaxy field has a spiral motion. Consequently, and as a further reaction, the spiral in the galaxy field begins to *tilt* the plane of the solar filament (which is at the present day still roughly the plane of the ecliptic), so that the solar main field becomes or stays more definitely a spiral, and so that the whirl is tilted with respect to the direction of its path as shown at S_1 and S—the latter being the solar system's present location (exaggeratedly high; §107b). And that agrees with the observed facts about the motion of the solar system as a whole, now. Also, it analogously truistically requires that the axes of our planets be tilted just as they actually are. And it further truistically requires that the magnetic poles of the earth, etc., be displaced from the rotational poles somewhat; and it is observed that they are so. Those magnetic poles continually vary in location, which indicates that none of the fields is steady—which is in agreement with 'no exact science.' Similarly, the tilt of the whole solar system would slowly change some, as it encountered varying strength and spiral of the galaxy field. That is a motion of the solar system which has not been directly recognized yet, so far as I can find.

d. There are no data known to me which will determine whether or not the solar system in past ages has had time enough [also youthful vigor enough, and-or environmental non-interference] to go on spiraling upwards, turning over the top of the Milky Way, until it made one or more complete revolutions in a spiral path about the galaxy *filiar* axis. Fig. 107e shows just a little more than one-half of such a revolution—and I have guessed that so much of travel occurred in 50 billion years. But there may have been many previous revolutions of the solar system about the galaxy filament, so that it may be nearly as old as the galaxy whirl—in fact, it is possible that by the calendar (by our arbitrary *L* and *T* verbal forms) the solar system may be older than the galaxy (but improbable):- for it may have been picked up by the galaxy as a galaxy comet *from another galaxy* (cf. §120), where it could have been born (or not) as described above (the heat of the sun will indefinitely survive, depending on *galaxy* conditions, as we shall see, so that it is possible that the solar system has been long wandering around as more or less a particular structure, or galaxy electron, from one galaxy to another). As a somewhat rash guess, based intuitively on the present 'smoothness' of the solar system,

my personal opinion is that our system has not made a complete revolution about the galaxy filiar axis, but has had a path somewhat as in Fig. 107e, although directions may generally be reversed from actual fact in that figure.

e. I shall here complete the general description of the path of the solar system, although parts of the description anticipate the statement of the concrete evidence. Such evidence is implicitly given below in the description of internal details or processes of the solar system.

f. As the solar system moves around to the central galaxy field in Fig. 107e, it obviously encounters a stronger and stronger spiral reaction from that field. Consequently, the path of S flattens out (the helix pitch becoming less, the path then expanding spirally). It is quite likely that now S is revolving around the galaxy axis PP′ almost in a plane, without helixing or corkscrewing up very much. It is somewhat probable (because S is so small) that S has, or nearly has, used up its energy of self-propulsion in an upward helix, so that the galaxy center field has made it spiral downward for a while. Then in such a case, S would wabble or oscillate up and down with respect to the galaxy filiar plane in a more or less circular orbit around PP′—which is mechanically identical with the possible wabbling of a large whirl in an orbit on the outer side (par. a). If the galaxy remains in a fairly steady environment, obviously such an oscillating orbit will *finally* be taken up by S, regardless of how many times it may have revolved around the Milky Way (unless S previously gets assimilated by some other structure). Also, as seen in par. a, all other secondaries finally get inside the hole in the galaxy doughnut and take up such an orbit. Hence, it then becomes inevitable, assuming sufficiently steady environment for the galaxy, that the systems in the central field will get crowded and will proceed to combine planetesimally into a central sun, as we shall see in the description of the formation of our sun. It is most likely, however, that before that happens (before the galaxy turns itself into a system similar to our present solar system—which would require perhaps some decillions of our years), the galaxy will "collide" with (which usually means "side swipe") another galaxy—both having become somewhat elaborate star clusters in that process of condensing (so that their fields have become comparatively weak and give less protection from such collisions). So the "end" of the solar system will probably be its combining with some other system, in that process of *galaxy* condensation. By the theory of chance (used in our ignorance of the actual pertinent facts), our system is likely to last more or less as it is now for some billions of years. The human race will nearly surely be wiped out by some *comparatively* minute changes in climate long before any such combining takes place, as is implicitly shown in the remainder of this section.

g. We proceed now to consider broadly the climatic variations in the solar system and galaxy; the minor variations of climate—those on earth—are discussed in §122. —— As S comes around under the Milky Way (Fig. 107e), it is obvious that what chiefly determines its path is the reaction of its field with the galaxy field. I. e., S is controlled mostly by affinity there, and but little by ordinary gravity. It is further obvious that the energy variations or asymmetries of the galaxy field ether flow which S encounters furnish the general, comprehensive cause of the variations in the internal growth of S. In general it is obvious that at first S uses its own energy (more accurately:- potential) largely (being of new-born, high potential), to screw itself along its path, in the direction opposite the flow of the galaxy field. As a general rule, it is obvious that such a wearing out or aging of S continues until such time as S oscillates near the galaxy filiar plane (as in the last paragraph), although there could be temporary reversals of that process at any time. We see the details of that wearing out or condensation later. We may note now that in general the reactions of the fields may be considered as regulating the speed of the various difference surfaces inside the solar system. And those speeds or potentials determine what we know as temperature, and the general phenomena of those difference surfaces or temperatures are bunched together under the name *climate*. Obviously, any variation of interaction of solar and galaxy fields modifies all climates in the solar system in proper proportions. Ordinarily of course we speak of the sun as controlling our earth climate (§122); we here merely go further back and see what controls the sun climate—in fact, *makes* the sun itself. We could go still further 'back' or "up" and show what controls and modifies the galaxy field (and so on in infinite regress), and say that *that* controls our climate; but the principle is always the same (§110cd).

h. As S starts off on its dotted path we have seen that it begins to revolve about the galaxy axis PP′. Now, as the galaxy is not a perfect or symmetrical structure it immediately follows that the revolution of S around PP′ is eccentric. I. e., S will approach closer to the Milky Way on one side of PP′ than it does on the opposite side. As a result of that rhythm or overrunning (analogous to the eccentric orbit of the earth, say) there will be a corresponding rhythmic variation of energy of interaction of galaxy and solar fields (analogous to the oscillations mentioned in the last paragraph, but on a generally smaller scale), and hence of the climates of bodies in the solar system. One side of the rhythm would be a rather warm geologic age and the other side would be a cold (glacial) age. I shall here proceed to write on the *quantitative* guess that that rhythm has produced the observed glacial ages; but obviously, the oscillations with respect to the galaxy filiar *plane* would always be present in some degree and would be a second general cause of large climatic variations, in a rhythm superimposed on the rhythm due to eccentricity of orbit about PP′. Similarly, it is obvious that the fairly near approach of our system to another solar system (say as close as a light year) would cause an appreciable variation in climate. And an irregular variation in climate could be caused by marked variations from smoothness of the Milky Way filament as S travels past them in its orbit; perhaps that is actually the most efficient cause of conventional "glacial ages." —— A geologic time scale of the earth, prepared from orthodox sources by H. F. Osborn, is reproduced from his "Origin of Life" as Appendix C (it is put in an appendix so as to be easy to find, it being a useful table). According to Sollas ("Age of the Earth," 285), there are observed to be at least three *general* glacial ages—"once at the beginning of the Cambrian; again, and more evidently, during the Permian period; and yet once again in times comparatively near our own," and observations show that three times there were intervening periods with climates considerably warmer than now. According to Osborn's chart the time intervals between those three general glacial ages are roughly 13 million years for one, and 16 for the other.

i. If we make a guess that the diameter of the *orbit* of the solar system around PP′ is something like 100 light years (that is probably too low a guess; cf. §107e), and that the system moves in that orbit at an average speed of 18mi/sec (that is probably too high), then we find that the length of a glacial year that is due to eccentricity of orbit would be about $3\frac{1}{3}$ million years. That does not agree with the 13 and 16 millions of the last paragraph. However, there are traces in recent times of six glacial "advances" in North America ("Ency. Brit.," xii, 59), and it is quite possible that each of

those is a mark of a glacial year or revolution about PP′. If that is a good quantitative guess, then orthodox guesses at geological time (those given in Osborn's table) have, with too much deference to Kelvin's bad guesses as to how long the sun could stay hot (he had no correct principle on which to base guesses), been entirely too small (cf. "Ency. Brit.," xi, 651ff). —— But we can get figures that seem discrepant in the other direction. According to Eddington ("Stellar Motions," 261), Charlier finds the node of the "invariable" plane of the solar system on the plane of the Milky Way to have a motion of 0.35 seconds of arc per century. If we assume that such "invariable" conditions actually do give roughly that average motion through a revolution of S about PP′, then a glacial year would be about 370 million years, giving the sun's orbit roughly a diameter of 10,000 light years, if we take the same speed in it as before.

j-k. I have included those badly discrepant guesses to show how uncertain and unguided by consistent principles present geological and stellar measures sometimes are. The obvious facts are that the revolution of S about PP′ is rather irregular, but as it takes several million years to complete a revolution the irregularities are not yet perceptible to us; and that there are other rhythms in its orbit which probably modify the glacial ages due to that revolution. Further, an oscillation of S with respect to the galaxy filiar plane would obviously make the orbit itself vary very considerably in size. And the Milky Way is itself observably irregular. And the orbit of S would have precession in the minor degree that "gravity" applied. Also, it is obvious that every time the solar system passed fairly close to another system, there would be a variation, as mentioned. Also, it is entirely possible that the solar system in its orbit about PP′ is so distant from the Milky Way that whatever eccentricity there may be in the orbit makes no perceptible difference in the climate, but that some of the other causes are efficient in producing glacial ages. —— Out of those several possibilities of variation, and some slight knowledge of geologic speeds, I intuitively judge that the time durations given in Osborn's table ought to be at least three times longer in the cenozoic, at least ten times as great in the mesozoic, and twenty or more times as great for the remainder, with perhaps 40 or more billion years for ages before the archean.

l. The "existence" of the human race obviously depends primarily or truistically on climate—for *climate* is simply the general name that implies certain conditions of dynamic equilibrium. If conditions are too much out of equilibrium the race as we know it will of course perish (or change enormously); if conditions are sufficiently stable a man could live almost indefinitely (see §123 for that consistent, possible "fountain of youth" or millennium). Any "end" of the race implies the entry of the solar system into an environment somewhat different from the present. Such a change could occur by our running near another system; or by running into a considerably changed part of the galaxy field (or by some analogous internal change in the solar system with reference to our earth and its field). However, a little consideration will show that no such marked change can rapidly occur—we are 'protected' by affinity or fields, and are not naked with a lone gravity. We would obviously take on such a change almost imperceptibly, and die off slowly during several generations if it were going to become too great for the present sort of race, and intelligent astronomers could predict the approach of any such end for thousands of years. Obviously, the solar system is supported and maintained chiefly by the galaxy field (mostly by affinity, and only slightly by gravity) in a fairly steady equilibrium that may last without perceptible disturbance for billions of years. So there is no need to worry about any "end" of the earth. As indicated, an actual end would probably be so slow as to be perceptibly painless. Also, any probable change of climate for the next ten thousand years could be met, by an intelligent people, by building suitable shelter. The rain will continue for a while to descend upon the just and the unjust, and the unjust will continue to flourish except for the process of slow suicide by stupidity which they practice (as we see implicitly in XVIII, XIX). Finally, of course the solar system will combine with some other system; and the race will perish some time before that begins very perceptibly to happen, provided we do not detach the earth from the system and sail off to a safer environment; theoretically that is easy enough to do (§123).

m. It therefore follows that if the solar system has ever made a previous revolution about the Milky Way (around the galaxy filiar axis), it is likely that the climatic conditions resulting eliminated much "life" that may have previously flourished. Hence, it should be kept in mind that there is a possibility that this earth has previously been peopled by a human race far more conscious (i. e., intelligent and definitely religious) than we are. So when in this book I speak of human beings, unless otherwise indicated I mean the ones on this planet that are included in the present time sequence of history, and I neglect some possible previous race(s) on earth, and races on other planets. They are all essentially the same, of course; but historical (i. e., quantitative) facts that apply to us, obviously do not definitely apply to those others. —— But even if S has made only the part of a revolution about the Milky Way, as in Fig. 107e, it is most probable that on a number of occasions conditions became sufficiently stable to permit primitive "life" to start "spontaneously" (§144) and continue for possibly a million or so years, and then be wiped out by some too great change. That is all the more probable when it is considered that this earth has never had a molten interior in the conventional sense (§119, etc.); quite likely the surface has been more or less molten on occasions even after it became rather large—it is now so, locally, as in volcanoes (and the seas and air are molten). I. e., 'geology' very probably began all over again, so to speak, several times. We could rather positively find out (by principles analogous to those shown with respect to meteors, §120), and get the previous history of the earth fairly well, by digging it completely up—examining all of it. I judge that it is not worth while to do that. But perhaps the astronomers will in a few years, by plotting the paths of stars, figure out our history fairly accurately for several hundred million years back. At any rate, it is obvious that geology and astronomy have barely scratched the surface of history, and that geology can stop skimping its time.

§113. a. We now begin to follow through the internal processes of our solar system. For some of the details of those processes I shall shift to a description of precisely analogous processes in Saturn, in comets, and in meteors, where the evidence is clearer. Such details will apply analogously to any whirl, depending on relative quantitative conditions. The chief new point to be considered is that *in* the virtually older solar system gravity is now of more importance than affinity, and we have 'reverse whirls,' or solid or spherical whirls, like our earth.

b. As soon as gravity does begin to be a rather effective force the processes become something like those asserted by the old nebular theory. That theory in effect used *only* a force of *attraction*, or gravity, *explicitly*. So formally it truistically would not work: for *any* positive language requires at least two parts to a machine (Part One), and Kant's starting nebula was just a single condensing ball, and it was then

impossible, even as a truism of his own dualistic logic, for it ever to become anything else. As a matter of actual fact, he tacitly did use an opposing force which he called inertia or centrifugal force. But he failed to be explicit about it, and to show definitely that it must be handled, logically at least, as this book does it. There is nothing wrong with the old nebular theory if that centrifugal force be consistently used. If it be, we shall promptly get an infinite regress, or mass varies with velocity, or an ever-varying machine of two explicit parts like our whirl and filament. For instance, Bjerknes ("Fields of Force," p. 10) is explicit about the same thing the nebular theory is mystic about, thus:- "Any body which participates in the translatory motion of a fluid mass is subject to a kinetic buoyancy equal to the product of the acceleration of the translatory motion multiplied by the mass of the water [fluid] displaced by the body." That is the same as saying that mass varies with velocity; and it is concretely exemplified by the doings of a whirl. So we can say that the nebular theory is quite right as religious language; the difficulty with it is lack of pluralistic positiveness. For details of nebular theory, see "Ency. Brit.," xix, 333ff.

c. Several men have with rather explicit validity worked out the gravity condensation of the solar system, and showed the detailed errors of the nebular theory. Chamberlin in "The Origin of the Earth," has perhaps done it best. Chamberlin is such a first class all-'round man that I think his book is worth reading merely from the point of view of having the pleasure of looking at such a man closely. He uses an *explicit* machine, consisting of two or more celestial [spherical whirl] bodies—which of course is theoretically equivalent to Reeve's theory (§92) if it be reduced to the ultimate. Chamberlin does not perform that logical reduction: on the contrary he tacitly takes it that the reacting bodies have fields which modify the formerly-orthodox gravity effect—and that is, in general form, equivalent to the whirl theory. The explicit astronomy in his book is definitely orthodox dualistic astronomy which he took over bodily from an astronomer who merely repeated Laplace's dualistic logic. But Chamberlin himself twice explicitly recognizes the effect of fields under the name of electric and magnetic action (ibid., 29, 148), as modifying (and strictly speaking, repudiating) that old Laplace astromical logic—or lack of it.

d. Explicit points in which the old nebular theory fails to work, and additional details of how gravity collects small bodies (planetesimals, to use Chamberlin's felicitous name) together into spheres such as the earth, when gravity is the chief force acting (i. e., when the whirl field gets too weak to hold the bodies mostly by its strength—by 'affinity'), can be found in Chamberlin's book. Eugene Miller in "The Origin of Our Planetary System" has expressed in an easily readable form a somewhat similar, non-rigorous theory, in which he deduces the solar system from two meeting spherical bodies, now the sun and Jupiter (without explaining the origin of those two). Jeans has worked out the same general idea mathematically—as have several astronomers. Miller makes his spheres rhythmic or elastic or overrunning; hence, his description, which may be considered as a brief but extended application of the well known tide theory of G. H. Darwin is *logically* equivalent to the whirl theory. But he omits explicit statement of *how* (mechanically or-and logically) a body can be elastic. To include that, he must explicitly solve the One and Many, and hence become formally identical with this whirl description (§101f).

e. The reader may get from those books detailed accounts of planetesimal action, if he wishes. So I shall condense to bare essentials the description of the planetesimal processes of the solar system.

§114. a. We have taken the solar system as a general case, having it a rather fluid whirl with a comparatively negligible amount of condensation of atoms when it breaks out of the Milky Way. It is to be repeated that it might vary from that in an indefinite number of ways. It is also to be emphasized that endless variation of the later internal processes is possible. I claim to do nothing more than show typical reactions. On account of the numerous possibilities —millions of perceptible ones,—for brevity I am forced to become rhetorically somewhat dogmatic. But it is requested that the reader remember vividly here that all quantitative assertions are just guesses and approximations, even though the inaccuracy may be of the order of only a second a century. A difference of that much in the period of the rotation of the sun *may* have made the difference between there being now an ultra-Neptune planet or not: the solar system is just that delicately poised quantitatively, as we shall implicitly see. We can't tell whether a leaf will fall this way or that in a wind unless we make elaborate measurements that usually are impracticable in the time available. It is a quantitative problem: the intelligible *qualitative* answer is that it will move in some direction if not held. And the solar system is a living being (for proof, see XVI) that *perceptibly* has far more parts in intricate quantitative dynamic equilibrium than any plant with its leaves—truistically; as a plant is only a small part of the solar system.

b. As the system comes out at C along the path in Fig. 107e it encounters a comparatively rapidly changing environment, and itself has a youthful high potential, as we saw. Consequently, the solar filament begins to break up rapidly —to give off secondary whirls. It probably in a million or so years began to take on the aspect of the whole galaxy whirl as shown in Fig. 107e. I. e., it probably by that time had many fairly large secondaries as outer spirals (the secondaries would be the "knots" in the spiral arms of photographed nebulas), and had numerous small whirls that had come around into its central field. The collection of whirls in the central field would obviously constantly increase, as we saw with reference to the galaxy; for as soon as a whirl field wears out some, losing some of its affinity factor, that secondary whirl is swept by the solar field into the central solar field. The secondary would there finally begin to oscillate up and down as we saw may now be happening to the solar system with respect to the galaxy field. But if the secondary keeps on wearing out, then it in turn will finally break up into condensations (like an old, broken-up comet; §120). Or in short, in aging the density of the inner structures of a whirl becomes too great, affinity can no longer support them as a *fluid* whirl, and by the experiments we saw and obviously as a truism of Bernoulli's principle or of the "dynamic buoyancy" of Bjerknes (§113b) they are swept out, the whirl condensing then mostly by gravity.

c. Thus the fields of the secondaries in the central solar field themselves become weak, and the secondaries combine, in some of the ways we have seen. Those secondaries obviously become more numerous and crowded as time passes, and the crowding accelerates the uniting of them, and the formation of relatively harmonious sizes of condensations (§100j). And with weakened fields, gravity has a greater effect between whirls, pulling them together ("electricity" is *markedly* or quite perceptibly the *quantitative* opposite of that; XIV). That force of gravity ultimately *in practice* or with respect to actual measuring is by no theory or measures Newton's or Laplace's mystical mathematical limit, but is merely what we may express as being the field reactions of touching whirls of *lower* orders—finally of cells (§103; Index, "Gravity"). And that is obviously merely truistic; for as

soon as the whirls show signs of disintegrating, then what we call gravity steps in (the measure of the gravity factor rises as and when the affinity factor falls; Fig. 104b), and makes them hang together in another, 'reverse' way. Therefore, *the total universe is now seen*, in the most definitely "concrete" aspect, *to vibrate or oscillate or exhibit rhythm about a condition of mean equilibrium*. And if we observed and expressed ourselves *perfectly*, then obviously by the principle of least action (§98m), the deviation of the *ultimate* parts of the universe is zero—which is the 'physics' or concrete form of the principle that man can not make an error (§25). Or, all things in the universe *are* ultimately *balanced*. Consequently, the ultimate ethical law, expressed in pluralistic terms, is that we should be balanced or temperate—*consciously* so, as we actually in ultimate fact are anyway, and are truistically partly dead, or part men, if we don't see it, don't "be" that way (XVIII). —— Thus we promptly revert to an inexpressible One in a very obviously truistic fashion as soon as we put gravity and affinity explicitly together. The keen reader can note that in all this "material" description I am constantly on the verge of the One and Many. To use the language of Cooke in his Introduction, only the austerity of the mechanics of our ether cell prevents our slumping into mysticism—which, while highly valuable in its place (Index, "Rebirth"), is truistically out of place when we are undertaking to talk a mutually intelligible language.

d. It can be seen to be a reasonable quantitative guess (in the absence of the mathematical establishment of a general periodic table), that, *inside* any collection of atoms and small whirls which constitutes what we call a molar body, gravity and affinity are about equally effective. I. e., in an ordinary molar body there is obviously about average equilibrium, and hence that equilibrium is so hard to upset that there existed before the discovery of unbalanced radioactive substances the erroneous quantitative anthropocentric guess that only a molar body was "matter," and that such matter was indestructible. On either side (Fig. 104b) of that equilibrium which from our anthropocentric point of view is fairly stable there is a less stable condition of equilibrium:- (1) that in which the fields are directly more effective, which is the condition we have been viewing in the solar system so far, and which, e. g., occurs in electricity; and (2) that form of matter in which the fields become comparatively less effective (never wholly ineffective or zero), and in which the parts are held together mostly by gravity, as, e. g., the planets in the solar system, and radioactive bodies *as compared with more stable ones* (*all* atoms are somewhat radioactive, in that *all* field surfaces give off some secondaries; XI).

e. Consequently, whether the worn out secondary whirls be broken up and the pieces swept out of the solar central field, or whether they unite (collide, mostly by side swiping) the result is finally identical:- the condensations or molar bodies are formed. In fact, those different ways of naming the processes are merely different points of view of the same process. E. g., if the whirls are broken up and 'swept out' of the central field, obviously the condensing is merely delayed, and takes place elsewhere, the condensations being finally swept back into what we may call the central condensation, as we shall see. I. e., the central condensations in the solar system produce our sun; some of the secondaries which get into the central field (as now happens with comets; §120) would be swept out, and would not at once combine with the sun, but would combine with (say) Jupiter; *but*, if there is time enough, Jupiter itself will finally condense into the sun (if there is not 'time enough,' then the solar system will itself condense or coalesce with another system, so *in effect* and in principle Jupiter condenses into the sun). So, regardless of the details, the processes of condensation continue—up to a point stated in the next two paragraphs.

f. However, at once the opposite effect appears (it actually always accompanied the condensation), thus:- When the fields of the whirls get relatively weak, gravity becomes of greater importance and pulls the whirls closer together—two filaments may unite into one; two whirls may alternately thread through each other; or there may be slipping or rolling on each other: those indefinitely numerous quantitative ways of 'condensing' give new elements, or chemical compounds, or solids, liquids, gases, and various combinations and modifications of those conventional things, ad infinitum. In coming together, the whirls overrun and hence make their field surfaces more energetic, and that produces in effect a single field which envelops the whole condensation (or, the fields may be said to coalesce into one; there being no absolutely distinct fields anyway, the two ways of expressing it are equivalent), the condensation *and* its unit field thus becoming in principle identical with an ether cell. That ether cell is a 'reversal' of a whirl (§98); i. e., we simply take a new point of view of it (mathematically, we emphasize the *other* factor of the pair in Fig. 104b we happen to be using one of, so that a numerical increase of it indicates travel in the other or 'reverse' direction on the curve); or we have verbally created that new, unit field, although actually it is nothing more than the summing up of the effects of two bodies which start going together and which truistically would *verbally* or logically keep on going or condensing until they became zero or monistic unless we thus changed points of view, or the trick of naming them (this being the *dynamic* concrete form of the inverse square law or the explicit *going* from one order to another). The definite mechanics of that are given in the chapters on light and electricity. Therefore, this summed up effect, or 'reversed field' of a condensation, by the overrunning of the gravity effects is truistically made more energetic than the weakened fields it replaces, so that for the whole condensation the affinity potential immediately rises and stops gravity's increase. E. g., the earth does not continue 'condensing' (by falling into the sun), but is supported by its and the sun's field so long as galaxy conditions stay fairly steady, revolving about the sun (§134j).

g. That is a general statement of the fact that potential remains fairly steady or *balanced* (there being only a rhythmic variation about a mean, due directly to the fact that the original criterion V_1 is not fixed or exact, and can not be). Or, it is a logical proof or self-consistent statement in terms of gravity and affinity, that each factor is mutually dependent and can not become either zero or infinity with respect to actual bodies; in terms of human life, no person (in the usual Many sense of *person*) can be absolutely born, or can absolutely die. And it is a little difficult to express and to understand in that general form, for the simple reason that we are in the habit of talking in terms of classical logic and the nebular theory, which explicitly tries to talk about *only* gravity, etc. So we may at once put the general form in terms of observed facts about the solar system. The sun and the earth are obviously *existing* condensations. Both are observed to have a unit field (it is called electrical or magnetic; cf. §§113c, 121; XIV). Obviously, those fields must modify the pull of gravity. Therefore, regardless of any relative values of those fields, it follows from immediately verifiable facts that our argument or description is self-consistent. As implied, the whole of XIV, on electricity, gives verifiable facts proving this perceptible variation of gravity and affinity about a mean, with a reversal of structure (it is a quantitative fact: not an essential change).

§115. a. We therefore have molar bodies—planetesimals

—with weak fields being pulled together in the central solar field. They keep on collecting to form the sun. There obviously would be no conventional "collisions" of those bodies, for all are protected somewhat by fields. —— When mostly gravity pulls two towards each other, obviously the fields as a result start speeding up the spherical difference surface that then forms for each; and that truistically is an increase of the surface temperatures of the two bodies (that is merely the ultimate and consistent mechanics of the common fact that compression of a substance usually makes it hotter). So it is obvious that the *surfaces* of the planetesimals will be comparatively hot, but their fields, and insides, will be colder. Consequently, the surface of the sun will always be kept relatively hot simply as the result of the reactions of the solar whirl with the galaxy *field*. I. e., so long as our solar system has a certain proportional amount of energy (relative to the galaxy field), then that long will the main bulk of the solar system (which is the sun—the rest of it now amounting roughly to less than 1/700 of the mass of the sun) have a surface hot enough to have a general V_1. The sun simply is kept *superficially* hot by the whole galaxy (and similarly the surfaces of the planets, etc., in their proper proportion). If the solar system tends to accumulate an excess of either affinity or gravity, so that the sun, with its certain relative size, cools or heats proportionally, then, just as in the last section, the solar system itself will condense or expand, and keep up the relative proportions and truistically restore and steady temperatures—up to a certain quantitatively critical point, at which the system will change order of structure. —— Obviously, that is merely another way of stating that the solar system is mostly supported in its spiral path by the galaxy field. So only as the galaxy field around the solar system varies considerably in energy can the temperature of the sun's surface vary much. In short, as the galaxy field as a whole is fairly balanced, especially with reference to small whirls like the solar system, all the bodies in our galaxy, of a size perhaps slightly larger than Jupiter as a minimum, usually have a surface temperature high enough to make their surface atoms visible—i. e., within V_1. And that is the quantitative basis on which this description of the universe was started; hence, the description so far is in general self-consistent, as we have circularly come back to that fact. —— And a direct proof of this paragraph is Adams's observation (I quote from a letter in which he refers to an article in "Astrophysical Journal," 45, 1917) that the smaller and less massive stars move more rapidly than the larger and more massive ones, the comparison being made between stars having similar physical conditions. And that is merely one form of the law that mass varies with velocity, or the astronomical aspect of Bernoulli's principle; or, as Adams puts it, the fact exhibits the principle of equipartition of energy.

b. And all that is obviously merely a particular way of asserting our original observation that everything is interrelated. We have seen that the sun's heat is thus sustained by the whole galaxy; so there is no fear of the sun's cooling off very soon. The conventional theories of the sun's heat ("Ency. Brit.," Art. "Sun") obviously imply the foregoing explicit description; but they get somewhat confused by laying the explicit stress wholly on gravity—thus fancying that the inside of the sun is hot so that the sun itself is directly a reservoir of heat. —— We see additional detailed facts confirming this section as we proceed.

§116. a. As the solar whirl S travels along its path in Fig. 107e the condensation of the sun continues. Obviously, the central field of the solar whirl is, dynamically, somewhat cylindrical, as the virtually younger Saturn is observed to be now in perceptible measure ("Ency. Brit.," Art. "Saturn"). —— That same modification of the figure of the sun, earth, etc., would still apply in slight degree. The exact figure of the earth or any other actual celestial body is not known, and is not exactly soluble. That figure approaches geometrical sphericity somewhat; so I roughly speak of spherical whirls. For the conventional mechanics of those figures, see "Ency. Brit.," Art. "Earth, Figure of."

b. Obviously, that general mechanics of condensation agrees with the fact that observed spiral nebulas have condensations in the center. Also, in our galaxy the condensation has not proceeded so far as to form any perceptible central sun or visible beginning of one; but most likely the center of our galaxy, on account of the comparatively numerous bodies there, looks, from other galaxies, as if there were the usual thick nebulous center—but possibly not; possibly our galaxy it too young yet. Our mechanics obviously not only consistently describe the formation of the sun, but they also agree explicitly with the observed distribution of stars with reference to the Milky Way:- they are thinly distributed at the galactic poles (P and P′, Fig. 107e), becoming more thickly sprinkled towards the Milky Way, as observed from our position near the center ("Ency. Brit., "Star"). Also, our mechanics obviously furnish an explanation of the various observed star drifts (same Art. "Star").

c. It is observed that the "surface" of the sun (which is fluid) rotates faster at the sun's equator and gradually goes slower as the poles are approached (the equatorial surface rotates once in about 25 days, and the polar surface in about 6 days longer). The same condition seems to have been observed on Saturn, and there is considerable evidence that our atmosphere acts in the same way (as we shall see, the sun [etc.] has a "solid" surface like the earth, as it is cold inside: but just as we do not see the floor of the ocean, we do not see that solid surface, except perhaps dimly in the middle of sun spots, and we do not know its rotation time). In the sun, the upper layers of the "surface" we see (i. e., hydrogen layers; "Ency. Brit.," "Sun"), rotate faster than the lower ones, and the extreme perceptible outer layer seems to retain its angular velocity as the poles are approached. Obviously, all those otherwise unexplained phenomena are directly consistent with our description of spherical whirls—or follow directly from Bernoulli's principle applied to ether cells. Also, that explanation is obviously equivalent to the discussion of temperature in the last section.

§117. a. The sun when condensing as described would obviously not only acquire a rotation about its axis, of the nature just decribed, but the sun as a whole, by the principle of asymmetry, would form somewhat away from the center of the solar whirl field (i. e., the axis of the sun would not correspond with the solar main axis). Hence, the sun itself would revolve about the solar main axis (about NS′ in Fig. 107e, although the center of the sun would be close to NS′), and the primary result of that would be that there would be an accumulated asymmetry which tended to make what was left of the solar filament finally split into practically two large secondary whirls (which process or stage of splitting would correspond to conventional "dumbbell" nebulas). Or, we can equally correctly say that the general unbalance of conditions due to the traveling of the solar whirl asymmetrically in the galaxy field (i. e., the start of the solar path in Fig. 107e obviously is asymmetrical with respect to the main axis PP′), would tend to give such a double splitting, while at the same time the same general asymmetry caused the sun to form with its center of gravity off to one side of the solar main axis. Both ways of stating the condition obviously give the same result, being merely different points of view.

And it can be observed in experimental soapy water whirls that the inevitable asymmetry even in a basin of water that is apparently still has a tendency to accumulate and produce such dumbbell or two-part splitting.

b. Parenthetically it may be noted that the infant sun would revolve in an elliptical orbit about the solar main axis. Also, the very young sun would itself at first be composed of many small condensations revolving more or less about each other in orbits controlled largely by gravity; the sun in that condition is a miniature star cluster. But that star cluster would be comparatively small, and hence would condense rapidly (say in a few million years) and form a structure with chondrules as in meteorites (§120). And the ellipticity of the orbit of the sun and also the ellipticity of the orbits of its parts before it was quite condensed into a more or less infant sun, would cause the condensations to sweep out considerable space; also, the oscillations of those orbits up and down near the solar filiar plane (roughly the ecliptic) would sweep out a further space; and all those reactions would accelerate the formation of the sun. For the details of that roughly described planetesimal condensation see Chamberlin's "Origin of the Earth." The essential point of the process is that the reactions tend towards the same result.

c. To take up again the probable dumbbell splitting, we can see that at about the time the sun begins to be a more or less dense cluster the solar whirl has a strong tendency to become a spiral nebula with two rather definite arms. Of course there could have been a number of smaller arms (secondaries and their debris, tertiaries, etc.) previously formed; also, instead of two arms, the whirl could have completely split into a number of secondaries, forming as many arms. Spiral nebulas of those varying characteristics are actually observed in the skies. —— And when the solar filament is thus nearly all dissipated as secondaries, obviously the filament is also comparatively much weakened so that the secondary fields are weak, and the gravity factor becomes locally more effective. That gravity factor then accelerates the condensing into spherical whirls, which whirls relatively have an effective strong difference surface (e. g., the hot or high potential surface of the sun), and those reversed whirls thus bring the affinity of the whole solar system up again, balancing the system with the galaxy whirl (§114c). Thus we again see the rhythm of structure about the One line of no resistance.

d. With that increase of gravity action there would be rapidly formed in the central field of each secondary a nucleus similar to the infant sun. Those condensations would form more or less in the solar filiar plane (which is roughly the same plane still:- the ecliptic; for that data, and for authority for other facts I use about the planets, etc., see "Ency. Brit.," Arts. "Sun," "Planet," "Planets, Minor," "Jupiter," etc.; for brevity I omit frequent citation of authority). However, a good many of those condensations, especially while they were in the rather sparse cluster stage, would obviously have their general outer field get comparatively so weak that the remains of the solar whirl field would sweep them out of the ecliptic, around the filiar axis, into the central solar field and likely into the sun (cf. §112a). In the past it is very probable that large planets (at least infant planets) have been thus swept into the sun; in the future when we get into the proper galaxy environment for it, other outer planets will be thus swept into the sun; comets now are obviously minor condensations which have had such a history (§120). —— It is most likely that novas or new stars which suddenly blaze up in a few days much brighter than they were before (and then more or less slowly grow dim) are stars which have thus been hit by one of their outer planets. The general disturbance caused by the reaction of the fields as the planet is falling could account for the minor preliminary increase of brightness sometimes observed in novas. One conventional explanation of new stars is that they are caused by ordinary stars' running into dark nebulas. The objection to that is that the various fields would prevent such a collision, and that the fields would in any partial collision be so strong that only very gradual results could occur. If Neptune swung around into the sun it obviously would make the sun blaze up quite a bit, and probably would burn up most of us humans; but it would not smash the sun appreciably, but would be superficially spectacular, like novas. It is therefore obvious that it is possible that the former popular fear of comets was a racial memory from the former days when some comets did do a lot of local damage. Neptune would make a rather large and dangerous comet. But no one need get frightened, as intelligent astronomers could predict such occurrences hundreds of years ahead.

e. If the solar whirl started out as a fluid whirl, it is likely that the larger secondary whirl of that possible dumbbell splitting was the beginning of what is now Jupiter, our giant planet. It is possible, of course, that the sun and Jupiter were two solar systems which approached each other and pulled each other into a gravity spiral nebula, as is tacitly asserted possible by Chamberlin and others. It is improbable, however. Certainly it is practically impossible that there were two *lone* stars, Sun and Jupiter, in the same neighborhood in the galaxy field; and the combination of the more probable Sun *cluster* and Jupiter *cluster* except by extremely improbable chances would have produced a *more complicated* solar system than ours is observed to be. It is likely that the astronomers already have enough data to determine at once the probable actual history as regards that possibility. The actual fact is, of course, that the solar system was never (except by one chance in infinity) a whirl so perfectly fluid as to contain no structures higher in order than ether cells: always it would start with some 'condensations.' Analogously, neither could it be a whirl or nebula produced by just two sharp and distinct bodies or condensations. Always there would be fields (affinity) to those bodies, and more or less of a cluster condition which would produce something of a fluid whirl. Chamberlin in effect asserts that; so there is logical identity between Chamberlin's planetesimal processes, and these whirl mechanics in which for rhetorical needs I am deliberately emphasizing affinity.

f. The solar system now, so far as has been observed, consists of the sun with four planets (respectively Mercury, Venus, Earth, Mars), then a gap in which there have been seen over a thousand small planets or asteroids (those asteroids often depart considerably from the ecliptic), then the four outer planets (respectively Jupiter, Saturn, Uranus, and Neptune), with various moons, comets, meteor trains, and gases. It is likely that the asteroids form most of what is left of the original solar filament (compare with the "dirt" in Northrup's filaments; §102d); there probably still remains a slight fluid motion of ether as a filament there, but its spiral has probably become nearly wholly a revolution about the main solar axis; some such motion might be detected by close observation of the orbits of asteroids. —— When the solar whirl became a rather well defined spiral it is obvious that most likely a number of comparatively small secondaries traveled around the solar filament into the central solar field. The sun by that time would have been at least a considerably condensed cluster, so that there would have been considerable space around the sun in which there was room for those whirls to survive, and to condense together in a proportionate way, thus sweeping out all that

space pretty cleanly. That would produce the four inner planets; it might have produced forty except that the quantities happened to be so related by the principles of harmonic periodicity (or here, by the principles of Bode's law; cf. next paragraph, §128, etc.) that there were four. Probably the other and smaller part of the original dumbbell splitting (if there was such a splitting) was Saturn. It would be protected by Jupiter; i. e., Jupiter would sweep out its space pretty cleanly, and would more or less break up the original solar field, so that Saturn lived in a fairly steady and weakened solar field, and hence lived very slowly and is now virtually quite young—compared with the earth; middle aged compared with the galaxy whirl. The two known planets now remaining still further out, Uranus and Neptune, are obviously condensations made up of other whirls left in the outer space. There may be a number of outer planets yet undiscovered; it is a quantitative problem not exactly soluble. There are surely some small condensations out there.

g. Now, all of those planets (including the asteroids as the averaged equivalent of one planet) may obviously truistically be considered to have field surfaces substantially equal in potential—in energeticness. In short, the reason Newton got his form of illogical law is that the planet field surfaces are rather weak and about equal. It therefore theoretically follows directly that, as their orbits are approximately in the plane of the ecliptic (roughly, are 2-dimensioned), then the proper harmonic periods for the space distribution of the planets would be with radii of orbits related approximately by the ratio 2—which by the theory of areas of circles ($Area = 4\pi r^2$), dynamically balances the structure and verbally balances the inverse square law. If we take the number 0.15 and form a geometrical series by multiplying it by 2, we have 0.15, 0.3, 0.6, etc. If we arbitrarily add 0.4 to each number, we have 0.55, 0.7, 1.0, 1.6, 2.8, 5.2, 10.0, 19.6, 38.8. The radii of the planets' orbits (the earth's being taken as 1.0; and roughly averaging the planetoids') are respectively:- 0.39, 0.7, 1.0, 1.5, (2.8), 5.2, 9.5, 19.2, 30.1. Obviously those radii are approximately equal to the modified geometrical series. —— That coincidence or empirical rule is known as Bode's law ("Ency. Brit.," "Bode"). Obviously, if Newton's law were accurate and logical we would not have those discrepancies, and would not have had to use the 0.4 (the use of which corresponds to the actual fact that the bodies are of finite size, and not zero or geometrical points as in Newton's law). But because there *are* fields, and bodies of finite size, the harmonic space distribution of the planets (including their satellites) requires first a general modification of the series in more or less equal degree for each member—that being accomplished by the 0.4. Then, there are two considerable discrepancies:- in the distance of Mercury, and the distance of Neptune. The spherical field of the sun is comparatively strong; hence the field of Mercury would be considerably modified, compared with most fields in the solar system, and would have its gravity pull considerably modified; and that principle properly exhibits itself in the discrepancy noted. (It is also definitely known from astronomical observations that Mercury perceptibly departs from Newton's law.) Neptune is exposed to the solar whirl field and hence like Mercury is pulled in closer by gravity and thus speeded up, bringing its field to equilibrium. —— In short, Bode's law is a series of numbers which roughly exhibits relative values of $W...\times A...$ in the solar system. If Newton's law were correct, Bode's law would be a series using 2 as a precise ratio: a perfect gas, where all space sizes are formally 0 or ∞, is such a monism. Bode's law, logically interpreted, is equivalent to Moseley's law, if Moseley's law is made to agree with the general law that there is no exact science, so that therefore Moseley's ratios are not considered ultimately exact, any more than Bode's are exact (§128). That identifies or unites the total solar system concretely with one wave or corpuscle of light, as is made implicitly obvious in the chapter on light (XIII).

§118. a. While the solar whirl was thus forming the sun, with planets revolving about it, each planet as a smaller or lower order whirl would obviously by the logic of identity and the mechanics of whirls be following precisely the same process, and we may observe in a rough way the various stages in the history of the solar system by observing the planets as they now are. Except for being of smaller size, and hence generally less energetic, Saturn is obviously now in the stage the solar system was, shortly after the sun had somewhat condensed from the central cluster of planetesimals—say 20 to 30 billion years ago. We may briefly observe some of the numerous details that are seen in Saturn.

b. Saturn has rings that are slightly tilted from the plane of its orbit (just as the ring of planets about the sun theoretically is tilted from the plane of the sun's orbit about PP'). Conventional theories are not definite as to the composition and mechanics of those rings ("Ency. Brit.," "Saturn"). It is mathematically established that Newtonian gravity alone would not support a fluid ring, and it is therefore orthodoxly assumed that gravity solely acts upon *small bodies*, keeping them in revolution and forming Saturn's rings. The obvious defects in that assumption are:- (1) only by one chance in infinity would the thin rings then be formed, or be capable of remaining in the same plane if once formed (i. e., the sole-gravity idea—or rather absence of idea—gives no fields to support or control the rings in that plane: the ordinary sole-gravity hypothesis of the general ring or plane of *planets* suffers from the same defect): (2) the rings are in some places practically opaque; they are clearly visible; and they cast a shadow on the body of Saturn; and those conditions obviously could not exist with rings of scattered particles (and have them sum only to the actual small weight of the ring), unless the particles were rather close together and mostly of small size, and hence were, by the electron theory, in effect a fluid (and that contradicts the original orthodox premise): (3) the whole ring has dark bands (or is split into concentric "rings") which apparently vary, and in effect the whole ring has six outer concentric rings that are six moons (there are four more known moons farther out, not quite in the ring plane); and the orthodox sole-gravity theory is helpless in stating why such conditions happened, or even why they persist, having started.

c. Clearly, if we consider the ring to be the vestiges of the filament of the Saturn whirl every one of those outstanding characteristics of Saturn is directly consistently established as a mechanical truism, similar to the explanation of the solar system, and the conditions of the ring are direct evidences of the truth of the whirl theory.

d. The ninth satellite or moon of Saturn has a retrograde motion. The pure-gravity or nebular theory can not account consistently for that retrograde revolution (which also applies to the two outer moons of Jupiter and to the moon of Neptune;—incidentally, I am not certain as to numbers of various sets of moons, for new ones have been recently found and I am depending on casual memory for these comparatively trivial facts). Obviously, the whirl theory would require, as being *quantitatively* most probable, that most of the inner condensations should revolve about the center of their whirl in the same sense as the revolution component of the spiral in the original filament. But *outer* secondary whirls obviously could easily get capsized, being exposed to the environment, and would then revolve in a "retrograde" direction; in fact,

such capsizing obviously establishes more stable equilibrium in the weak outer field (Chamberlin's planetesimal theory, in using defective astronomy, omits showing definitely any similar strengthening of equilibrium that amounts to a check on the gravity process; and the theory thus more or less fails to locate positively the probable place for retrograde motion).

e. I shall be more explicit as to the "dark" bands, and the orbits of the six inner moons that are in the ring plane, and are hence in effect equivalent to six more bright rings—or, are equivalent to more or less *definite* electrons *in* an atom:- The combination of the two forces $W...\times A...$ would obviously, by our theory of harmonic periodicity, sort out or sift out condensations of the same spherical field surface intensity, arranging those of the same intensity at a properly or harmoniously proportioned radial distance from Saturn, thus arranging those of the same intensity in a ring concentric with the rings in which were those of other intensities—the least effective intensity being outward, and hence truistically becoming distinct moons, in which and in the formation of which obviously gravity is stronger than affinity (than field surface). When the field surfaces of the condensations become still weaker, they are obviously then not able to hold the moons in the plane; and the stronger gravity disturbances among themselves and other bodies throw them somewhat out of the plane (enough out to strengthen their field surfaces, and establish harmonic equilibrium with other planets, etc.). So obviously, if we were observing the six inner moons from afar and had retinal persistence enough so that they remained perceptible streaks of light all around their orbits, they would appear as such streaks or *rings* located in harmonious proportions *or as a spectrum* (XIII); and the irregular outer moons (irregular in the sense that for them there is not a nearly complete balance of W and A relative to just the Saturn structure) would be bright bands of perceptible width—that might be bright enough over a wide enough radial distance to be a "continuous" spectrum. In short, the Saturn rings, by exhibiting directly the varying proportions or effects of W and A exhibit what we might call a *molar spectrum*; also, they show a sifting out or *'concrete periodic table.'* Obviously, therefore, the dark rings would be due to the fact that at certain places in the varying balancing of W and A, conditions lacking equilibrium arose, and the 'atoms' were pulled to one side or the other of the circle in the whole ring which would have been their location had they been stable there (being thus changed or 'condensed' into the more stable-sized bodies away from that circle): so in the neighborhood of the circle there would be few if any surviving condensations of the particular size that would balance there, and hence too few reflectors or givers of light; and therefore "darkness." That is identically what happens, with direct reference to harmonic proportions or 'periods' of comparative equilibrium, in the formation of the periodic table. Obviously, there could exist a band in the ring in which over a comparatively considerable radial distance there is such a proportionality of W and A that there is practically *continuous* equilibrium, and hence no perceptible trace of dark rings or gaps, but a thicker collection of condensations: and a precisely analogous condition occurs in the chemical periodic table, with respect to the so-called "break" containing the rare earths, which break corresponds to one of the brighter, wider bands in Saturn's ring (App. A, atoms 57 to 72), and in the solar system as the rather continuous band of asteroids. It it not a "break," but the absence of a break—the actual breaks (where we may say that the rhythms of various—several—properties get out of step) or dark rings occur between the ordinary "elements." And a secondary and hence more pronounced rhythm of such lack of breaks is evidenced by the groups in column VIII of the periodic table. —— There is in the table a considerable 'dark band' between H and He. It is obvious that in that space other "elementary" atoms *could* exist temporarily, but not very stably; and Thomson (in experiments on canal rays) made some of those atoms that existed for perhaps a short time. —— This paragraph could profitably to physicists be expanded to a volume. I haven't gone far into the subject—which is why the paragraph is vague and ambiguous.

§119. a. Further, depending mostly upon the energetic condition of the main solar field, it is obvious that additional outer moons of Saturn might be held in the plane of the ring. If the solar field were energetic, and the Saturn filament were young enough to take up some of that energy or were conditioned so as to balance with it, then the Saturn field would hold additional moons in its ring, and the ring would be wider. And in the same circumstances, the small-condensations part of the ring would extend farther out, before those condensations would collect into moons of weaker affinity. So as a truism, in such circumstances Saturn would be "heavier," or would have a higher 'atomic weight.' Therefore, if on earth we subject atoms to considerably heavier pressure for a long time (other conditions being fairly steady—as would reasonably be the case deep inside the earth), then that would be equivalent to giving them a wider ring and increasing their atomic weights. It therefore follows that inside the earth there are most probably (in principle absolutely are, *if* the quantitative conditions are right) atoms of higher atomic weights than any we have yet observed—just as there seem to be, by the same principle applied to opposite quantitative conditions, elements in nebulas (where the pressure is light: where there is plenty of room) that are lighter than any we have got hold of on earth. So if any of the heavier internal atoms got extruded by volcanoes (§122), they would begin to have their 'outer moons' grow more loose and unstable. And under proper quantitative conditions (especially is time enough needed for the results to accumulate) some of those outer moons would break loose from the atom, and we would have the phenomena of radioactivity—identical in principle with ordinary secondary whirl formation described in XI, but quantitatively probably involving considerable heavy condensations as just described. In the solar system comets represent radioactivity *with respect to the internal parts of the system*; i. e., comets *nowadays* are a very mild degree of internal radioactivity which would correspond to internal electron formation with respect to atoms —a breaking up so mild in degree as usually not to be called "radioactivity." To get conventional radioactivity as exhibited externally by ordinary atoms, we would have to have the solar system as a whole react *perceptibly* with other systems, and it happens that at present there seems to be no such perceptible reaction, in which pieces break out of our solar field and go as a comet to other systems—as a rather large secondary. But obviously, the principles are consistent and simple, as shown. Clearly, there could be a long series (really in infinite regress) of 'periodic rhythms' of new and heavier atoms under long-continued heavier pressures. Obviously, in steady conditions of pressure the atoms would not perceptibly change any more than the solar system as a whole is doing. Therefore, inside (say) the earth where the conditions are fairly steady there would be no perceptible breaking up of the atoms (no "radioactivity"), and hence no appreciable heating from that cause: there may be a comparative trifle of heating effect from radioactivity in the surface layers of the earth. So from that point of view also, the insides of the planets, etc., must be cold (see also §122i); only their surfaces have sufficient disturbances of equilibrium

to produce much heat. There would be breaks in the rhythm of those heavier elements, similar to those in our periodic table. And the atomic weights would keep on going "up," or the periodic table keep on extending itself, to some variable limit in a given planet. The principle defining that limit is truistically this:- if a whirl happens to be energetic enough to form an atom of a weight beyond the harmonious limit, it will be unstable and break up.

b. Similarly in the other direction, towards the H end of the periodic table, there is a lower limit of atoms for our average conditions. At that limit there is a gap in *our* 'molar spectrum' which is equivalent to the change in order of whirls from atoms to electrons. But that gap itself in different quantitative conditions is subject to variation (cf. the discussion of spectrum in XIII). So obviously, this is merely a repetition of the infinite regress of harmonic periodicity given at length in a general way in §101. The way to get a definite and applicable numerical and rigorous statement of the theory is to determine the structures of atoms in ways to be shown, then tabulate the rhythms of their properties as Richards does in his Faraday lecture, and combine the two.

c. Furthermore, it is directly obvious that although the harmony or rhythm of proportion of all whirls or atoms (based on V_1—or on any other given criterion) would remain steady, so that *relatively to its environment* C always has the same properties roughly, yet an atom of C in one environment by no means necessarily contains (and by only one chance in infinity could contain) the same quantity of ether cells, as a C atom in another environment. For it is obvious that all of the condensations in the Saturn rings which are of a fairly stable size and which as a sum form a ring of certain radius, and which condensations we may say are analogous to C atoms, would have to contain a different amount of "substance" (really, of a *fixed* verbal or logical space and time; cf. Part One) in order to occupy the same *relative* ring (of relative properties) in a system other than the Saturn system. Yet in both systems those condensations at similar relative locations would be C. For obviously, if the two then differently *weighing* C's (referred to a fixed standard quantity of ether cells) were not *both* the same consistently named C, then we would get a practically identical spectrum (with reference to its most perceptible portion) from "*different*" elements. In brief, W is only *one* factor, and irrational alone, and there can be no constant atomic weights. Or in familiar language, circumstances alter cases—that quantitative truism implying that the relations or principles stay steady. —— Therefore, because of different past history two atoms may apparently be built the same with respect to easily perceptible properties of a certain sort (such as roughly having the same spectrum; or roughly having apparently the same "chemical" reactions), and still have perceptible differences in weight. As a matter of truisms, of course those different past histories have made the two atoms *somewhat* different in *every* characteristic or property. (And as it is truistic that no two things can occupy the same space simultaneously, therefore each thing in the universe has had a history, and hence has properties, different from every other thing.) It merely happens that in the general theory of harmonic proportions the weight of the two varied appreciably more than some other properties: theoretically, there is no reason why the reverse should not occur (that the weight of two atoms should be practically the same while the two differed appreciably in other properties); and allotropic forms are actual examples.

d. And obviously, any interaction of the Saturn whirl with any other whirl (planet) will make the orbits of the moons (and everything else in the whirl) get smaller or larger. Any sort of atoms are therefore directly compressible, in complete agreement with Richards's theory (§82).

e. It would be easy to go on for volumes giving the general principles of atomic structures, as they are directly evidenced by the structure of Saturn. Those volumes are omitted for several reasons:- (1) The reader who is interested can work them out readily, and will find it more profitable and enjoyable to do it for himself. (2) The volumes are actually rather useless until they are expressed in observed measures with some fair numerical precision. And that is an enormous work I have scarcely touched, and of which I am mostly in ignorance. Quite probably I have consequently made silly quantitative errors in the foregoing, and it is better to stop before I make those errors worse.

f. It is possible, by further using Saturn as evidence, or by using other facts about the solar system, to go on and show in considerable rough detail why the sun and various planets should have their actually observed densities, masses, tilts of axes, speeds of axial rotation, virtual ages, etc. Obviously, all those properties are completely related by $W... \times A...$, and we can readily get rough verbal statements of the relationships out to a considerable number of dots, even in the absence of the more precise mathematical expression. (The chief reason we can so readily get consistent expression of those relationships here is because we are working in the actual three dimensions; that verbally compels a statement of real structure.) But probably most readers would find such a necessarily lengthy statement of technical astronomical detail both confusing (for this first general view of the universe), and also tiresome. It is not actually needed by the intelligent reader, as it is merely a detailed application of principles already seen in general working. So I shall end this astronomical chapter by giving some odds and ends of details that are illuminating, and also perhaps interesting.

§120. a. We briefly consider comets (for authority for observed facts used, see "Ency. Brit.," Art. "Comet").

b. We have seen that any whirl would have some condensations. There would be numerous condensations in the older spiral nebulas such as the solar system, or even in the considerably younger Saturn. In the virtually very old spiral nebulas such as the earth-moon system, those condensations, especially the larger ones, seem to be rather cleanly swept out by the planetesimal process. However, even in the case of the earth-moon there is considerable evidence of the existence still of lighter condensed whirls (§121c). For verbal simplicity and brevity let us explicitly consider only the condensations which are scattered in the outer parts of the solar whirl field. The nearest star to us so far as known is nearly four light years distant (if I remember correctly: it was discovered two or three years ago). So it is probable that the field difference surface of the solar whirl is, in the plane of the planets, *at least* one light year distant from the sun—about 60,000 times the distance of the earth from the sun or 2000 that of Neptune from the sun. Hence, comparatively there would be considerable room for condensations beyond Neptune. Possibly there are some fair sized planets out there—probably retrograde. But at any rate there would be some small whirls there that are more or less aged into clusters. Also, in that weak outer solar field there would be a tendency for the gravity of the scattered clusters to become relatively strong enough to pull them into larger clusters; and the process of forming those clusters would create a sufficiently strong field (increase its A) so that there would be a stronger reaction of cluster field and solar field, and the cluster would get swept out of the ecliptic, around through the solar field into the central field where the sun is. Also, precisely the same thing would obviously tend to occur

as the result of any disturbance of the solar field if the whirl ran into a somewhat different environment—if our whirl came close to another system, say. Those are merely additional details showing again how outer fields are cleaned out.

c. Those clusters (or virtually old secondaries, or whatever else we name the possible variations) as they sweep around into the central solar field are *comets*. There is no very complete orthodox explanation of comets and their phenomena; but as we shall see, this whirl description completes the orthodox explanations with obvious consistency, and shows in even more detail that the whirl theory is universally consistent. Of course, those comets could be born from practically any part of the solar system; or a planetary whirl could give birth to a comet into the solar whirl field; but only briefly in pars. gh shall we consider those variations.

d. Those clusters would have such a comparatively weak field that the sun's gravity pull would act rather strongly on them to pull them towards the sun when they got started in their swings around. That increased speed would truistically give more intense reactions of solar field and comet field, and the comet field would therefore do two general things to the comet cluster:- (1) the cluster would form into a rather definite whirl which comparatively very rapidly started condensing into a central nucleus (central 'sun'); (2) the comet field rubbing energetically on the little fields inside would make them heat up the surfaces of the condensations. And both of those mechanical results give subsequent phenomena precisely as are observed in comets. In general those phenomena are these:- (1) As the comet gets near the sun the nucleus could be either a cluster or an actual condensation into an infant sun (or of course any intermediate stage). Observations of comets have not definitely determined whether the nucleus is an opaque condensation, or a cluster that we can see through pretty well; clearly, our theory would give both possibilities, and that will make plain all the questions as to the mass and densities of comets, and of their observed breaking up. (2) And the spherical surfaces could heat to incandescence without much affecting the parts inside of those fairly thin glowing surfaces (for direct proof, see par. k). (3) Those surfaces could vaporize into more or less fluid atoms or molecules, and all the visible phenomena of comets would follow, as is readily obvious, but as will be stated in slight detail below.

e. As the comet came nearer the sun and its speed increased its spherical surfaces would gradually get hotter, and would finally vaporize some. (That vaporization is obviously itself a giving off of secondary whirls: a less *degree* of the same phenomenon gives sun-spots, volcanoes, storms, etc.; §122.) That vapor or collection of atomic secondaries would fill the field of the comet with visible whirls, and so we see the whirl field in photographs of comets. Also, the rapid speed of the comet causes numerous births of secondaries from the outer field surface of the comet, so that the atoms get 'outside,' into the solar field. Then partly due to the pressure of light, and partly due to the fact that those field difference surface secondaries have reactions of their own which cause them to screw themselves rapidly through the solar field in a direction away from the sun, the tail would form. Obviously, the lighting-up of the comet and the formation of the tail would take place gradually as the sun is approached, and die away as the comet recedes (and both are clearly functions of the comet's mass, speed, etc.,—or, in general, of the comet's balance of *W* and *A*).

f. Also, certain sizes of those tail secondaries would obviously not be in the necessary harmony of proportion to survive. So there would be a preponderance of certain elements in the tail. Also, there would be a *3-dimension balancing of elements in the tail*, (1) in the direction of the axis of the tail; and (2) because of the swinging of the tail, markedly in the two dimensions at right angles or radially from that axis. In Saturn the balancing of the condensations in the ring was practically perceptible in two dimensions:- radially from Saturn in the plane of the ring, forming concentric rings. Because Saturn moves in an orbit tilted with respect to its rings there would theoretically actually be a component of balancing across the thickness of those rings. Such has not been noticed: there is a remote possibility that it might be perceptible if looked for. —— Consequently, we have the 'elements' of the tail being periodically separated or sifted out in 3-dimension "fans" and "knobs" and "kinks," etc. And such phenomena are actually observed. A comet's tail is therefore obviously a 3-dimension 'molar' or 'chemical' spectrum; or, the tail gives an automatic "analysis" of the whirls which can survive. So the description of comets' tails requires volumes, omitted at this point and practically unknown to me. As a matter of rather obvious fact, the greater part of the volumes I mention omitting is unknown to me.

g. Obviously, if the field of Saturn were in some way rudely disturbed in the proper direction, the field would give birth to a secondary that would be, with nearly certain probability, a small comet. Also, it would partake of the components of motion of the Saturn whirl. Hence, usually it would not be in harmony, either in size or orbit, with comets formed in the outer solar field. So except in rare cases a Saturn comet would not survive long, but would most probably be swallowed up by Saturn on the passing of the disturbance. That shows that the tendency in the solar system, so far as its internal processes are concerned (and if not 'interferred with' by outside systems), is to keep on in the one direction of 'condensing'; for a large whirl in it can reverse (as Saturn was there seen to do hypothetically), but does not do so except temporarily. Hence, most of the comets probably come from beyond Neptune; possibly some are born in the vestiges of the solar filament, and a few small weak ones may come from the Saturn or the Jupiter whirl.

h. A comet may be born at the solar field difference surface, either into the solar system or out of it—any asymmetry there obviously forming a comet or secondary (§98w). But when comets are born into the solar system, in precisely the same way as seen in the last paragraph (by the theory of periodicity) only comets of some certain sizes could survive very long—others being quickly assimilated. (And as an obvious incidental fact, the formation of comets of any appreciable size would mostly take place into the equatorial parts of the solar whirl field, because the flat polar parts of the field are more stable.) As those field surface comets are obviously directly analogous to electrons, it becomes obvious why electrons (i. e., electrons in an explicitly conventional sense:- those *given off* by "atoms") are roughly of a certain proportional size, and why any disturbance of atoms produces electrons. We see at once, again in complete agreement with the last paragraph, that a comet born *into* the solar system would have practically no chance of traveling very far into the solar system in its original form. It would be making a considerable disturbance of equilibrium along its path, and unless the solar system had received a severe jolt (which seems to be improbable in its present rather isolated location), the comet nearly surely would not be large enough to get far without being assimilated. And that agrees with the observed fact that no comet yet measured seems to have come from outside the solar system; it also agrees with numerous facts about electrons. The comet from outside quite likely stirs up the solar system more or less to start a comet in the regular way; and that is equivalent to saying that the

comet from outside does swing around the sun, but that it has changed its quantitative character and thereafter is a solar system comet—has been 'assimilated' in that way. And quite possibly such a comet, in being assimilated, starts a series of reactions which will in turn cause the solar system to give *out* a comet—so that an observer outside might think he saw a comet pass *through* the solar system, whereas the electron or comet that came out was composed of quite different materials, and was variously different otherwise. We may observe that the way our own physiological cells "assimilate" food, or "eat," is quite analogous to this comet or electron formation. The cell and its molecules will turn the food into its "own substance," just as comets are finally to some extent assimilated by the sun; and part of the food will necessarily (it is necessary or truistic because ultimately there is no symmetry or commensurability in any part) start some series of reactions that will cause a 'comet' to be given off by (say) some molecule, which rejected part is "not wanted" or a poison (XVI). It is obviously all a matter of quantitative variations in sizes, etc.; the principles are the same: for when we consider that process of assimilation with respect to a biologic cell, molecules of various sorts are taken in, instead of electrons, and then molecules of different sorts from those taken in are observed to be rejected—showing in another way that the electron absorbed by an atom is different from the one given out.

i. So it is obvious that perhaps most of the comets would come swinging in to the sun on orbits considerably elongated; in fact, in practice it is difficult to distinguish some from parabolas. And because of the obvious theoretical interference of fields, and to the gravity pulls of planets, numbers of comets are likely to be slowed into short orbits—and such is the orbserved fact (incidentally there is a perceptible harmonic periodicity to the sizes of comets' orbits). The comet with the shortest orbit yet observed is Encke's, with a period of about 3.29 years. And that comet perceptibly fails to obey Newton's law. We have now seen why. Another fact of the same general sort about comets, which shows directly that we must consider fields as well as ordinary gravity is the observation that the long axes of their orbits tend to trail out in the wake of the solar system as it moves in its own orbit about PP′; only the reactions of fields —of *A*—could produce that phenomena.

j. Comets are of a comparative size that is unstable. Obviously by our theory, and by direct observation, they break up, and the sun and planets begin to sweep up planetesimally the pieces which have thus been transported from the outer parts of the solar system, and from outside the system. The pieces are called meteors or meteorites (I shall not make the usual minor distinction; see "Ency. Brit.," "Meteor," "Meteorites," for definitions and for details of the observed facts I use). The earth sweeps up many meteors, and we can observe them in flight as shooting stars and fireballs, and examine the occasional ones which survive until they reach the earth and are found. It has been estimated by astronomers that 400 million meteors telescopically visible fall on the earth each 24 hours.

k. Some of those meteors fall as fireballs, which, according to the vague observations available, seem to be clusters of condensations (minature systems) that definitely form whirls in our atmosphere—seem to be definitely comets in our atmosphere. The meteors which reach the earth show only two definite molar structural formations:- (1) there is evidence of their surfaces having been heated; and (2) often these are chondrules or spherules (roundish grains varying in size from microscopic to that of a walnut) imbedded in a rock matrix. The obvious explanation of those chondrules is that they are planetesimal condensations with hot surfaces and hence rounded forms that rain down upon a hot-surface nucleus in a comet, and are imbedded there—sometimes the nucleus afterwards being broken up by some large unbalance. A reference to the Art. "Meteorite" will show that no other explanation is probable. So we have here direct experimental evidence of the whirl theory or some equivalent one, and of the fact that heavenly bodies are relatively cold inside. A comet exhibiting chondrules would probably be of average size, whatever that may be; for obviously, larger ones would melt the rain of planetesimals more or less homogeneously into the remainder of the nuclear substance, and small ones would not be hot enough to imbed chondrules.

§121. a. It has been repeatedly seen that there can be no perfectly fluid whirls, or on the other hand perfect spherical condensations which would exhibit Newton's monistic gravity. Always by consistent mechanics there must be difference surfaces giving off an infinite regress of secondaries—or any actual body must be in some intermediate stage of being a nebula of which the zero-infinity limits are (1) a unit fluid perfect whirl with no secondaries, and (2) a unit perfect solid sphere with no interacting body. That sentence summarizes this chapter in concrete terms of the One and Many.

b. It therefore follows that the sun, earth, moon, Jupiter, comets, etc., would each severally, and all as a sum, have in some degree an accompanying nebulosity. Comets have that nebulosity in marked degree—being often accompanied by its extension into a tail. Also, in full agreement with our verbal truisms of description, the sun, and earth, and probably the moon, have nebulosity which is visually perceptible to us. And we shall see implicitly in electricity (XIV) that any body has electrical fields, which are always experimentally perceptible if its relative motion is sufficiently great; and those fields are equivalent to nebulosity. The nebulosity of the other planets is too far off and tenuous to have been noticed yet, except for that of the young Saturn.

c. That nebulosity which surrounds the sun is faintly visible to us as the *zodiacal light.* The similar nebulosity of the earth is named the *Gegenschein* (for description and more detailed observations, see "Ency. Brit.," "Zodiacal Light"). The nebulosity of the moon has not with positive certainty been observed, and it has not been named; obviously its visibility would be interferred with by those other two nebulosities. Such nebulosities would probably be somewhat self-luminous (agreeing with Angstrom's observations in the article cited:—and in spite of the fact that they are in space usually held to be at nearly absolute zero); also, they would be luminous by diffused and reflected light (as our atmosphere is—they being obviously composed largely of thin gases that are known to exist in the "free" space about us). The nebulosities have probably been observed to vary in position, and perhaps to exhibit some traces of tails: they seem to have a variable tilt, and seem to react mutually. All such observations obviously agree with whirl mechanics.

§122. a. It has been seen (§112g-l) that the reaction of the solar whirl field and galaxy field gives our general climate. We shall now see that the whirl theory consistently gives minor climatic variations by the same principles—seeing it by considering the reactions of the sun's spherical field with the earth's spherical or magnetic field. —— Also, it follows implicitly, but of course in far less quantitative degree, that the reactions of the moon's field on ours modify our climate. The empirical farmer who plants by the moon's phases is not wholly superstitious, although it is likely that his rules of thumb are now excessively inaccurate, and are merely racial memories persisting from the ancient days when the earth and moon were in a younger whirl, and their

mutual field reactions were much stronger. Even the old astrology is not completely stupid; for millions of years ago when (say) Jupiter swept near the earth spiral, it probably knocked off an earth satellite which plunged into the earth in a way somewhat disconcerting to live things in those days. Astrology was perhaps perceptibly justified in some measure. Of course the intellectual grafters exaggerated it and ritualized it until it became silly; they will do the same for this book unless men take the trouble to observe for themselves. Those grafters were not deep-dyed villains; they merely desired to give their clients their money's worth, and hence "improved" their yarns to give them sufficient violence—pep and punch and heart interest—to jolt even the weak brains of their stupid dupes, and thus give them a sensation to vary the "monotony" that is another name for an inactive mind. Also, the dupes wouldn't rely on themselves, but relied too much on "experts"—with the usual result that both they and the experts (named astrologers then) came to grief. All too specialized specialists are dangerous.

b. The chief cause of those minor disturbances of the sun's spherical field, and hence of the earth's field and hence climate, is obviously the eccentric revolution of various bodies around the sun. Possibly the most *intense* of those variations are the passages through perihelion of comets, or the remains of comets; obviously those comets then stir up the sun's spherical field sharply.

c. When one of those sharp knocks on the sun's field occurs, obviously there would shortly be secondary whirl formation at the sun's difference surface, which 'surface' is conventionally divided into chromosphere (at the bottom), photosphere, corona, and zodiacal light ("Ency. Brit.," Art. "Sun"). Similar knocks on the earth's field would also produce secondary whirls here; those whirls are directly perceptible to us as cyclones and anti-cyclones in the atmosphere (which is part of the difference surface of the earth). A cyclone is a whirl in which the central field travels *up* (is a

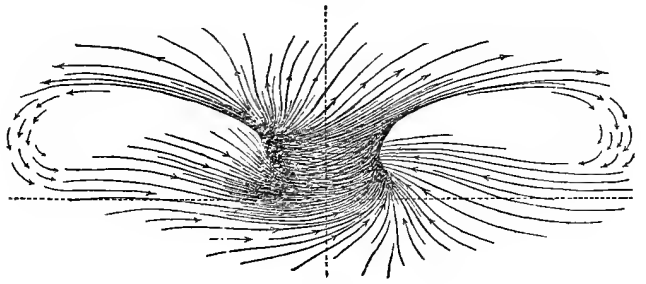


Fig. 122c.

whirl born *into* the earth's field), and which therefore is not much interferred with by the "solid" earth, and so produces or is comparatively rapid motion of the air, and is a "hurricane," "storm," etc. Fig. 122c is a diagram in perspective of the wind circulation of a cyclone, and it vividly outlines the filament difference surface of a whirl, even definitely as to the spiral motion. I did not manufacture that picture and emphasize the whirl characteristics to prove my point: the picture is reproduced from Knight's "Seamanship." An anti-cyclone is a whirl traveling in the opposite direction (*out of* the earth field); hence, the solid earth interferes with the air motion of it, and the wind slows down, and we have "pleasant" weather. All our "wind" is a result of whirl formation.

d. Those two kinds of whirls are observable in or on the sun, in greater degree because the sun's 'surface' is thicker and relatively more fluid and extensive. It may be possible that a sun spot is formed *directly* by an anti-cyclone; it is a quantitative problem, and I guess that such is not the case (chiefly because an anti-cyclone on the sun would spread out widely, like one here, and a sun spot is rather sharply local). A cyclone on the sun would obviously consistently produce the observed high flare-ups of the corona, and the prominences of the denser photosphere. A very small cyclone here, over such fluid (e. g., water) will produce a waterspout, or on land will lift dust, leaves, etc., high into the air as a "*whirl*wind"; any cyclone lifts up the surface of the earth some, but not very perceptibly with the solid earth: the barometer becomes "low," showing that comparatively there is some suction on the earth. The waterspout, on a certain harmonic proportional wearing-out of the whirl, slumps back into the water—one nearly slumped on me once. Similarly, anywhere on the sun a localized, considerable actual lift of material will take place as the result of a cyclone. (That material seems to streak out in the high-speed winds in the upper atmosphere of Jupiter, and make bands around that planet.) That material will then slump back into the sun, and by the usual principle of overrunning it will make quite a hole or sun spot in the photosphere. So a sun spot is most likely the dying out of a cyclone on the sun. Obviously the cyclone gave the material a rotation (that can actually be seen in an ordinary waterspout; also see Fig. 122c), and naturally the sides of the sun spot hole will have the components of that rotation. Also, the dropping of the prominence into the surface is equivalent to dropping soapy water into a basin; and a whirl will result, with other sorts of rotary motion. So for all those reasons, the spot will endure for a time—perhaps as long as a month or two. Also, the spots, like the more violent of the storms on earth, will tend to be near the sun's equator, as it is there that both more field energy and more chances of getting a knock exist. The whirls from the knocks would obviously travel away from the equator as they move down, by compounding their motion with the sun's rotation.

e. Every one of those whirl results is definitely in agreement with the observed facts about sun spots ("Ency. Brit.," "Sun"). Further, observations by Hale, and mechanical guesses and observations by Julius, show that there are such rotary motions. Turner gave a theory of sun spots to the Royal Astronomical Society ("Sc. Am.," April 4, 1914), which shows that known comet orbits agree with the periods of sun spots; the most marked one is about 11 years, but there are other superimposed periods [ad infinitum, according to valid logic]. It is also observed that electrical apparatus on earth shows variations ("electrical storms"), indicating such variations of electrical fields, occurring for a few days *in advance* of visible formation of sun spots. Further, a considerable body of observations now exists, and scientists are beginning to agree, that our minor climate in general varies coincidently with variations in the sun's surface (of course after "seasonal" changes). It therefore is obvious that all this evidence verifies our mechanical theory.

f. Obviously, we bave come to the beginning of writing a consistent science of climate—of general, and daily or seasonal, meteorology. That would require volumes—omitted.

g. And a general consideration of the foregoing astronomical descriptions, combined with a more specific detailing of the variations of the earth's spherical field (including the history of the earth whirl), would constitute the base of geology. Chamberlin gives that well in "Origin of the Earth," although not explicitly about the earth field. I shall make brief remarks on geology, indicating that expansion:-

h. Obviously, ultimately any asymmetry of equilibrium of the earth's surface would be referred to the earth's field, and so on to our galaxy whirl, and so on. Most likely, due to past stirring-ups of the solar whirl by its approaching other

whirls, the earth's surface has several times been hot enough to be rather fluid. The earth's field would then perhaps have considerable effect in distributing the fluid matter (in principle, precisely as the matter in a comet's tail or Saturn's ring is sorted); in short, ultimately there is no "chance" about it: the earth itself is a chemical spectrum, probably several times repeated, or superimposed—of which the conventional geological strata would constitute one "layer" or order. And that gives a rigorous qualitative beginning for the geology of the shaping of the juvenile earth, which is of course in agreement with Chamberlin's balancing of various factors with gravity, in his chapter on the subject. I merely bunch all his various other factors into *affinity*—or into the concrete field, which primarily displays that affinity.

i. There would then, as a truism of such surface asymmetries, be regions of less pressure in the earth's surface zone, so that the condensed, aged atoms there would move around more, and thus in some measure break up, and thus give off small, rapidly moving parts ('comets' or electrons, or other larger parts in radioactivity) which sum as heat. In the deep interior of the earth there would not be a high enough *degree* of variation in stress to permit that breaking-up to occur; that such breaking-up actually does occur when pressure is removed is observed directly as small surface explosions in new walls of mines. And that heat would, under proper quantitative conditions, as a truism, accumulate, melt the more easily melted substances, and by keeping on increasing if pressure is decreased at a sufficient rate, eat its way upward, and out at the surface, as a volcano. So a volcano thus always tends to make a more stable equilibrium—to smooth out past asymmetries,—which is substantially how Chamberlin puts his more detailed description of volcanoes. Therefore, from both points of view it follows that the interior of the earth can not be hot; for if it were, asymmetries or differences of potential would automatically increase as we approach the center of the earth, so that at the center the potential, having *nothing* ever to start it the other way, would truistically become infinite, and the earth would blow up—and it obviously does not. Or, if that general proof that the interior is cold is not readily intelligible, then a concrete proof is that it is an obvious truism of the whole theory of the shaping of the young earth (either as given here, or in the form given by most modern geologists), that a crust can not form on a liquid core which is asymmetrical or out of stable equilibrium (which would have been the case with the earth) unless the crust be nearly instantaneously formed with sufficient thickness to hold the liquid core (which is a silly hypothesis). Or in brief, as the little boy puts it, if the earth *were* hot melted stuff inside it would largely leak out through the holes. Of course, if we dig a large hole in the earth, it follows from the foregoing that it becomes a volcano—the walls would keep getting hotter as we went deeper. Obviously, if we went deep enough, with a hole big enough not to be self-plugging, we would automatically get a flow of "melted earth." If we could keep that hole from plugging itself for a while, the flow of liquifying interior would soon leave unsupported places that would more or less break up the earth by earthquakes, and thus (probably before changes in center of gravity, etc., became effective) would indirectly plug the hole and stop the unbalance (the earth will "heal" a wound just as a human does—only on a larger scale). But none of that proves that the earth is hot inside; it merely proves that the earth is so constructed that we can make an artificial volcano—by the simple process of digging a large enough hole. The sides of the hole is a modification of the difference surface (an extension of it); and the principle is that that surface *is* comparatively hot, and obviously the considerable unbalance of the hole would make it locally hotter.

j It therefore follows that any prolonged asymmetries or knockings-about to which the earth field are subjected would produce, as an accumulated result, an age of volcanoes. Any such series of asymmetries, given enough room (and there usually is ample space in the galaxy), would inevitably be balanced by reverse ones, and there would be a severe glacial age before or after the volcanoes. And such rhythms are geologically inferred to have occurred. So the general basis of geology confirms the whirl theory, even if I do have to be a trifle unconventional and conclude that the earth is cold inside. It has been my actual experience that the same sort of people who were shocked by Columbus's heretical belief that the earth was round are greatly offended by the proof that the earth is cold inside. So in order to help those mentally rather run down people over their emotional disturbance, I have devoted an otherwise disproportionate amount of space to the point. —— The keen reader will also observe that I ostentatiously and emphatically give such people an unconventional point of negligible direct practical importance to be horrified over. That serves as a counter-irritant, permitting the painless introduction of an important point or two.

§123. a. As a general summary of this chapter we may consider, in terms of astronomy, the millennium, heaven, Nirvana, or Utopias in general. Obviously, because our astronomical terms are universal, and are also consistent mechanics, we shall be able logically to consider the 'heaven of heavens,' or a sum of all Utopias (i. e., get an inclusive theory of heaven); and at the same time get it in an engineering form capable of actual achievement, provided people want such a heaven enough to achieve it. —— The way to get it is to make the earth into a flying machine and move it to wherever we calculate we need it in order to achieve such equilibrium as we consider to be heaven—for, as we shall see, all Utopias are nothing more than quantitative perfection (at least as an aspired-to limit) and hence eternity of balance between two or more bodies, which themselves therefore become eternal as such finite bodies. In brief, the conventional heavens and Utopias are quantitative: to be blunt about it, they are grossly materialistic in the ordinary dyslogistic sense—and in their aspired-to infinite limits are of course not achievable. But we can approach as near as we like to *any* Utopia or heaven by properly moving the earth out of its orbit. People who in general are more or less unbalanced, or intemperate, or radical or exaggerated in one way or another, are truistically pained by the condition (see XVIII); so they verbally invent a heaven where they think the balance is better. For the human reasons for that, see §155. —— Or, there is another sort of person who is callous or insensitive nervously, who *fails* to get enough stimuli from the environment that are violent enough to jar him into much consciousness. So he complains bitterly of too much monotony, and invents (or usually accepts from others) a verbal heaven that is violent or "peppy," and that would be painful to the radicals; the Great White Way and Greenwich Village in New York is somewhat such a heaven. If the radicals could get their sort of heaven it would be painfully monotonous to the callous people—would bore them worse than this world does. But obviously, the callous sort of heaven is the same *essential* sort of heaven as the radical one, being simply expressed negatively or in the opposite quantitative direction, so that the same principles apply. As a well known fact, the practical achievement of some of one heaven satiates, and causes the sufferer to strive for the other; e. g., the denizens of the New York heaven "long" for the "simple life." —— In general, orthodox heavens are

merely materialistic, quantitative, selfish daydreams. But we now start to examine them a little in detail, as they give considerable useful information.

b. We have seen (§114c, etc.) that *any given geometrical point in us or near us, or anywhere, is itself in eternal perfect balance with the rest of the universe*—moves in the path of no resistance, as being or exhibiting either zero energy or infinite energy. Consequently, eliminating merely formal time and space we obviously have a perfect heaven, in *all* respects, right now, and right here, eternally and everywhere. Further, if we take any pluralistic (or time and space) part of our world, we have seen by astronomy that it is actually in perfect balance (*so far as we can perceive*) with reference even to a fairly small environment. E. g., we and all our things are so perfectly in balance with just a few galaxy whirls that we can not perceive even with senses aided by our best tools more than a few of them—the remainder balancing into infinity or nothingness, whichever way you want to say it. So with reference to any time-and-space thing—with reference to our personal, arbitrarily limited selves, say—there clearly is, inside a quite restricted environment, a *perceptibly* perfect balance (and then many people object to that heaven by wanting to make a "stir" in the world; and having made one, they find that such unbalance is not what they want). It therefore follows that *actually* we are in a heaven or perfect balance so far as we can perceive, if we take a wide view.

c. However, men look around them and by taking a narrower view (by excluding or ignoring some of the things which they actually see) they observe that in that narrower world there are unbalances. E. g., they see the lightning kill an apparently innocent baby; or they see apparently unbalanced distribution of food, so that some people not directly responsible for that distribution starve. So men start making quantitative computations intended to remove those more narrow unbalances, and the conclusion is called heaven. E. g., the old Hebrews apparently judged that "pain" was bad, and all unbalances of day and night and climate were bad (they having no electric lights and furnaces to remedy such), and that there was not enough of brilliancy in their surroundings (that judgment included the objection of the callous to monotony): so they devised the grossly materialistic heaven of Rev. 21, which sounds like a longshoreman's idea of "elegance," and which is substantially the orthodox ignorant "Christian's" heaven still, except that the usual Utopia of the ignorant person contains the additional proviso that there be no "work." The majority of the polygamous Arabs apparently failed to have their sexual appetites satisfied, there not being enough women to go around; so they figured out a heaven with an abundance of such satisfaction —overlooking the needs and desires of women in it. Clearly all Utopias propose to achieve some more or less narrow balance, and they ignore the perceptible unbalances that will be produced elsewhere as an inevitable result. E. g., all conventional heavens I know of propose to reject some people; obviously, the concoctors of those heavens thus tacitly admit the existence of an unbalance in them, and so stultify themselves. All the people who propose to reform or remould the world nearer to their heart's desire, propose usually in actuality to change a narrow unbalance which annoys *them*—and they truistically produce perceptible unbalances elsewhere (although they usually overlook that fact or deny it). That is what is wrong with the reformer and radical: he in effect denies that he causes unbalanees elsewhere, and is hence rather foolish, as he does (and sometimes for the good of the majority). Of course, *everything* we do is *locally* an unbalance. We take up the solution of all that in ethics (XVIII). We simply note now, from the typical evidence given, that Utopias are quantitative. Our conventional theological heavens are obviously grossly dualistic and aristocratic, with their more or less benevolent potentate, or *permanent* chief boss, who is reputed to require as much deference or kowtowing as that desired by any small man in official position or by a hysteric. A kaiser and Jehovah are obviously alike in essentials.

d. Therefore, as all Utopias and heavens are merely more perceptible balances within certain limits at the expense of increased unbalances elsewhere, then the obvious goal of intelligent Utopias is to get the unbalances located as much as possible so as to be imperceptible to all men. Clearly, the way to get a balance having the widest limit would be to get the whole earth into some place where there was the least variation in reactions received by its fields. Therefore, if we create an artificial field (like an artificial house over the whole earth), which will promptly react with most modifications from foreign fields, we can make the climate fairly equable (probably we would have to take secondary steps to prevent other undue unbalances). By moving the earth out of the solar system, we could progressively achieve a more and more perceptible balance:- its rotation could be substantially stopped, thus stopping most changes in light and radiation; its revolution about the galaxy axis could be so smoothed out as to be imperceptible (or we could move it out of the galaxy if we wanted less motion); and we could progressively level off its surface, etc. By proceeding in that way all perceptible change would be gradually eliminated. All processes could be equalized until the passage of time became practically imperceptible, there being nothing happening in particular by which to mark time—not even *perceptible* monotony. Hence, in that soothing, somnolent environment men would practically quit dying (or being born —for birth is a perceptible unbalance); death would be abolished to the degree in which closeness of balance was obtained (XVI). Also, all work and other perceptible activity would be similarly eliminated. Further, our brains would stop acting in the same degree, and we would have practically no pains, no troubles, nor any perceptible consciousness of any kind. In short, concretely and literally we would be bored quite "stiff," and for all practical purposes be dead. —— In fact, the consistent expression of the condition is that we would be so completely bored that we could not even die in the usual manner, but would imperceptibly enter upon the equivalent of it without perceptibly physiologically dying —a state of affairs worse, nominally at least, than the mythical fate of the Wandering Jew. Fact of course is always stranger than fiction. The human race is far too stupid to invent any quantitative complication that is nearly so surprising as those actually about us. —— Obviously, therefore, the very perfection of that heaven is its condemnation, from the point of view of our personal tastes. We simply do not want any such millennium. The lion would lie down with the lamb all right—and stay that way. In fact, the able engineers who, it is tacitly assumed, would get the earth started off towards that Nirvana condition would also automatically lie down and stop work (unless they had built themselves a private dwelling in which they could have some manufactured unbalances)—and in the first case the earth would automatically return into some condition sufficiently asymmetrical to jar the sleepers into life. —— Incidentally, it is obvious that in such a heaven, where there is no perceptible unbalance, there would be a practical and perceptible constancy of all physical quantities, and also a practical exactness of all science. In conventional language, bodies or things in it would be practically dead, and practically "really material."

e. Obviously, no one but a mental defective or some man hopelessly worn out by this real everyday heaven we have now, would want that consistent astronomical Utopia or summed-up orthodox heaven. If any man truly does want it, he can easily get its substantial equivalent by buying a few cents worth of rat poison and eating it. For obviously, we have such a *perceptible* heaven when we are dead (i. e., we have no more personal consciousness—a condition equal to that heaven; for proof, cf. Index, "Immortality"). And any scientist who thinks he really needs physical constants and an exact science can readily get them, so far as *his* perception is concerned, by the same judicious use of rat poison; the only other direct way he can get them is by moving the earth (or a part of it, including himself) to such a condition—and even then it is likely that *perceptible* exactness would be limited to quite a narrow locality on earth (*perfect* exactness of course already now exists, and would then, with reference to any *zero point*). —— It is a well known fact that many people who claim or fancy that they believe that the promised theological heavens exist after death, and who go about asserting in effect that heaven is their home, they being timid orphaned strangers in this present wicked world, still refrain from proving their sincerity with rat poison. In short, the people who claim to believe orthodox Utopias, in practice fail to act as if they did (for their psychology, see §155). They of course contrive some excusing "argument" about the wrongness of suicide—thereby unescapably implying that the God who inhabits their heaven keeps them away from it, and hence is either a dog in the manger or else possesses that vicious, perhaps lowest Hun characteristic of teasing, tormenting, tantalizing. The obvious solution of the problem of suicide (as implied by the investigation later of immortality) is that it is a quantitative problem, and is right action when the suicide thinks more good than harm is produced by his death (i. e., it is right from *his* point of view; others often agree with him, in which case the action *is* right so far as it is possible to judge; §171k).

f. Having shown that the orthodox heaven is as stupid as the already unfashionable orthodox hell, we may now examine the mechanical details of making a flying machine of the earth. It is not likely that we shall ever want to fly away to a consistent heaven; but it is possible that at some time we may want to use the process to modify the climate a trifle. If we get too crowded on earth, we may possibly want to add the moon to the earth in the way of a real estate addition. It would be an exceedingly hazardous business, but it could perhaps be handled: the moon would bump rather hard when it coalesced, but we would have acquired quite an increase of potential, etc., if any of us survived such a get-rich-quick scheme. Also, it is well for us to know our widest quantitative capabilities (*anything* is possible quantitatively): then we shall have an explicit means of refuting the weak-sisters who insist on whining about impossibilities, when what they really mean is that *they* feel comparatively feeble—and want us to be like them.

g. We shall see in §§140-1 the principles of how to get enough power to work the machines we are going to use to make the earth fly—fly differently from the present. We can apply that power, by using large electrical machines, to modify the earth's field—such modification being obviously the same in principle as creating a field in a motor (XIV). Truistically, that will move the earth relative to the sun; the earth field difference surface is obviously the fulcrum Archimedes was looking for. By making the difference surface relatively stronger we make gravity relatively weaker, and we have in some humanly controlled degree harnessed the solar whirl field to the earth, and can work ourselves out of the present orbit. Very slowly at first would we move from that orbit; compared with any power we now develop on earth, the power to move us appreciably would be enormous. But as we moved out, gravity would have less and less effect, and we could proceed faster. Theoretically, it is exceedingly simple thus to harness up the total galaxy. Practically, the quantitative difficulties are large.

h. This chapter shows explicitly how the earth and each atom and electron in it is definitely and completely bound to the total galaxy environment. If we actually know the structure of such environment, then obviously we can, by guiding parts directly in our reach, control the earth. So a summary of this chapter, showing briefly its consistency, is a statement of how to move the earth. Unless such a statement can be given as a part of an explanation of the structure of matter, then obviously that explanation is either not intelligible, or is not complete and consistent (or both). So this section is proof of the consistency of the chapter.

CHAPTER XIII. *Light.*

§124. a. It is obvious that I have been describing phenomena as being ultimately the giving off of secondary whirls —as being the result of asymmetries which accumulated at difference surfaces *in sufficient quantitative degree*, compared with the ether cell size, to cause a *number* of ether cells to unite in some way to form a new whirl, or at least perceptibly start forming a new whirl. It is equally obvious that because the ether cells are taken to be of some finite size, then there may be asymmetries of insufficient quantitive degree to form such secondary whirls: but nevertheless there still would not be a *zero* phenomenon (as the cells are finite, as just stated), but as a verbal truism there must be some phenomenon—and so on ad infinitum, as we arbitrarily take ether cells to be smaller and smaller (or larger and larger, to go the other way:—e. g., we have in §128 the description of the spectrum of the solar-system-considered-as-an-atom, in which 'atom' the earth would tacitly be just a few ether cells). —— Such a comparatively nearly zero phenomenon is named light (that use of *light* is a relationship word). Obviously, just as we have what were called orders of whirls in harmonic periodicity of mutually fairly stable sizes, so we would have orders of light (there *light* is definitely a Many word, or light is just plain "matter," if we take it as corpuscular, as we shall see we may; but if we, also properly, take light as waves, then that use of *light* is the orthodox combination of a Many word *and* a relationship word—a double use which ordinarily is "ambiguous," but which we can use clearly as we know the logic of it; cf. §134a). Three orders of such a phenomenon are conventionally named, as noticed before:- electric waves, ordinary light, X-rays. Ordinary light is given off by ordinary atoms, electric waves by collections of atoms, and X-rays by structural parts of atoms. We saw that there were no sharp boundaries between those "orders" or species of light. There can of course be as many sub-orders of those orders as we care to distinguish—or super-orders. It is probable that physicists now lump together quite a number of rather distinguishable sorts of light as "X-rays," as we shall see.

b. A logical or truistic proof of the general existence of all that variety of lights, and probably a more intelligible description of just what light is, may readily be obtained by considering different sorts of difference surfaces and *all* of the phenomena (in addition to secondary whirl formation) which take place all the time at or in them. We are going to see that in conventional language light is usually considered to

be waves, or *definitely* a *continuous* fluid phenomenon. And that is verbally the reverse of our secondary whirl descriptions—for obviously, in all of the latter we had some degree of definite internal structures; now, in wave light, we have none, that being truistic with *continuous fluid*. So we must at once redefine our various orders of difference surfaces, to agree with that new way of talking. And that is simply and obviously done by saying that the ether cells of a given whirl are large enough to be considered elastic and not to have *definitely* named internal parts; i. e., we merely take elastic parts of the various orders of whirls large enough to permit us to leave unmentioned (*but never absolutely ignored*) previously considered internal structures. Obviously, that is only a verbal change; for we saw that an ether cell was merely a whirl considered to be continuous (§§97-8). Hence, we now have to notice all phenomena occurring when we do consider whirls continuous. Heretofore we have tacitly ignored all those of a "size" so small as not to form 'secondaries.' But clearly, a secondary can be *any* size; so explicit whirls, or Newton's corpuscular light, *can* be used to explain *all* phenomena, including light. Similarly, by increasing sufficiently the arbitrary size of 'cells,' ordinary wave light *can* be used to explain *all* phenomena, the earth (say) becoming then a vibratory wave (see §128). Light and (say) astronomy are thus obviously identical; the two conventional subjects are merely two verbally different ways of stating observed facts. Because we are familiar with the wave-light way for many phenomena it is easier to understand them when that way is used. So I describe light largely that way, especially as it furnishes a check on the way used for other phenomena.

c. We therefore at once note that by our new or explicit fluid definition of 'cells,' any difference surface (regardless of its practical size) will be considered to be a layer of cells, which layer rubs the adjoining layer of cells in (1) outwardly the touching field and (2) inwardly its own structure. That adjacent layer (in either direction) is in actual or virtual motion at some spiral angle between the monistic limits 0° and 90° to the surface layer (§98o, etc.). —— Hence, as we shall implicitly see, light waves (not necessarily ocularly visible ones) are generated *everywhere always*. But again basing ourselves on the measure V_1 we consider usually only the generation of them at difference surfaces we have already established by that criterion. That amply covers the phenomena (includes positively all of them): for all the light generated (say) inside a filament thus determined is summed up in its surface cells, as we shall see.

d and e. It clearly follows that as those cells rub across each other, cohering or sticking to each other, then by the mechanical principles of elasticity already established, they will mutually distort each other, overrunning the equilibrium and then letting go of each other, so to speak. The cells will therefore vibrate or oscillate, truistically stirring up their neighbors progressively into similar vibrations (Huygen's principle; §126)—the result of all that being light. Obviously, *any* asymmetry will result in continuously changing or modifying those vibrations all over the difference surface of any whirl; consequently, there is always continuous light phenomena (perhaps not visible), because by our arbitrary agreement as to cells, such motion of parts, to infinite smallness or in infinite regress, is truistic. Obviously, therefore, conventional light phenomena all explicitly imply the infinite regress; here, we are merely having it explicit. In *definitely* pluralistic language, such as the talk of secondaries in astronomy, only an asymmetry of a certain size compared with the size of the ether cells could produce a secondary; hence secondaries form only occasionally and at particular places on the difference surfaces. Here, we see that light is not thus localized, but is continuous (not necessarily visibly).

f. It is possible in many ways to get a tangible concrete model of the mechanics broadly described in the last paragraph. Northrup's whirls (§102) show a hazy vibratory surface. Often smoke rings, or smoke sheets in still air, will exhibit a more or less definite surface vibration. Practically all of Bjerknes's experiments (§94) are definitely vibratory, and can be shown to be analogous to any light phenomena. Possibly the quickest way to see the mechanics of the last paragraph is to take an ordinary round bristle brush and flick the ends of the bristles. The ends will vibrate, often perceptibly for a while, analogously to a small place on one of our arbitrary cells, and by the same principles (although in a different degree, as the quantitative relations of the anchoring of the bristles are in considerably different proportion from those of the 'anchoring' of the parts of the cell:—if it be required to have a quantitatively proportional model, then a tore can be made having a 'surface' of mounted gyroscopes; Erwin's model is substantially that; §94). The same sort of vibration can be seen when the wind blows over a field of high grass, wheat, etc. By revolving and sliding the bristle brush mentioned under the finger the ends of the bristles will temporarily perform oscillations analogus to cells. By properly moving the brush in and out of water visible experimental evidence of at least the general principles of any of the mechanics of light is obtainable; however, it is usually easier to prove those mechanics by reducing them to truisms equivalent to Bernoulli's principle.

g. The mutual reactions of those vibrations give all the unending light phenomena. Because of those unending possibilities of reaction, of the ad infinitum orders of light, and of the ad infinitum asymmetries which cause light, there can be no complete description of light. For that reason, and also because light is substantially a repetition of astronomy, and because we have already seen the general mathematical identity of light with other branches of physics, I shall condense this chapter to a brief outline of the subject—just enough to give a general understanding of it, and indicate the foundations. The only substantial variation I make from the orthodox descriptions is that I have light 3-dimensioned, and so describe it. Orthodox descriptions in actual effect of course do have light in three dimensions; but the orthodox mathematics are mostly of the 2-dimension, transverse-wave sort that lead to difficulties, and are of course totally meaningless when *explicitly* interpreted, because no such thing as a "pure" transverse wave ever existed or ever can—it being merely a non-existent verbal abstraction of a mathematical character. Quite naturally that sort of mathematics used in the texts (which conceals the problem of the One and Many) orthodoxly winds up in the well known self-contradiction in light, which may be expressed in one way:- that Fizeau's experiments and-or astronomical aberration requires a still ether, and the Michelson-Morley experiment requires an ether dragged some at least by the earth (see Wood, "Physical Optics," 1st ed., XXII). An ether cell is 3-dimensioned, and by considering it as producing light we keep in 3 dimensions and readily see the cause of the orthodox difficulty with those experiments (§127).

h. Incidentally, because light may equally well be represented by whirls instead of "waves," it follows that light *is* whirls from that point of view. And that of course is equivalent to saying that light is matter (cf. par. a)—or is ether. And that again is equivalent to the conclusion in the last paragraph that light is 3-dimensioned. We shall see how ordinary atoms grow, or decrease, according as light is added to them or given off. Of course that growth is minute —perhaps with no weight perceptible by present balances.

i. This section is a general summary of light. If the reader is not particularly interested in physics or mechanics he may skip this chapter and the next on electricity, or read them casually and inattentively, without losing anything essential. Easily perceptible experimental details are so numerous in light and electricity that I can on any line of observation quickly so overburden my memory with them as to become almost hopelessly confused as to what are the next consistent details. If the reader finds that he has the same difficulty he need not feel alarmed: those details are merely some of the infinite dots of our formula which have become perceptible, and as they are infinite, everyone must necessarily fail to follow them at some stage. Because I must condense violently in this and the next chapter in order to include explicit unifications which will be required by the physicists and which must be known by the experts in any branch of knowledge, it results that the two chapters are hard to follow—especially if the reader has more or less forgotten his physics. He already has all the essential ideas of the "material" universe which he needs in order to follow the last summarizing chapter of this Part (XV), and the description of man in Part Three. Some of this chapter on light describes mechanical reactions so complicated (i. e., numerous in one "phenomenon") that I find it easier to think them through "originally" with "pictures" of them in my "head" than I do to follow my own condensed written description of them. There is no need for the general reader to worry himself with any such stuff; but any good physicist must.

§125. a. At a given cell on a filament surface we may conveniently name the three directions thus (and we need to remember these names, as they are frequently used in light and electricity):- (1) the direction roughly perpendicular to the filiar axis (or when the filament cross-section is not somewhat circular, then the direction roughly perpendicular to the surface at the locality being considered) is *radial* or *normal*; (2) the direction roughly parallel to the filiar axis is the *filiar* direction; (3) the direction roughly at right angles to those two, or (what is the same thing) the direction roughly parallel to the cross-section circumference at that cell, is the *circumferential* direction. The same names are obviously analogously applicable to similar directions at any difference surface (at a field surface, e. g.). The last two directions, filiar and circumferential, together will be called *transverse* directions. Obviously, any cell in the difference surface is asymmetrically supported or held by the surrounding cells; that is a truism of any pluralistic language (or the principle of rhythm or incommensurability), as we have seen in the truistic proof that whirls themselves exist (XI). Or explicitly, under average conditions it is obvious that the cell is held more or less steady in the transverse directions and hence has a comparatively more free component of motion in the normal direction. —— Or, if the reader does not approve that assertion involving such quantitative directions, then the principles of pluralistic language or asymmetry require that (in agreement also with all observed facts) there be different energy of motion in the three directions, and he can assign that difference in any combination of directions he likes. If he changes from my (conventional) directions, he will need to change the wording of the description, but will obtain the same general result (cf. §99).

b. Therefore, the given cell in the difference surface will by cohesion elasticly react with the field cell [or cells] touching it, and because of the opposite spirals and asymmetrical support produce in that field cell a minor elongation having unequal components in the filiar direction and the circumferential direction. But most of the elongation will take place in the comparatively unsupported radial direction, and will be similarly propagated by that cell to the next cells, and so on (Huygen's principle; §124d). —— The whole reaction is a ray of light. Obviously, in the first two directions—the directions *transverse to the ray*—the ether cells are structurally supported so that the resistance to deformation is comparatively enormous, whereas the cells in the normal direction, or direction of propagation or travel of the ray, are structurally held only by the comparatively weak field difference surface, etc., so that the resistance to deformation is slight, and the light wave would 'form itself' or "travel" in that direction very rapidly. Further, it is obvious that *always* the ray would be encountering—would be *composed of*—cells which were in varying structural relations, and hence *the three components would always be varying*; or, in short, never on a path composed of as few as three ether cells could the ray travel either *straight* or at a *constant speed*. Equally obviously, the various components, being produced by friction and hence subject to friction would wear out (i. e., become diffused among many cells) in a length of time depending on the character of the motions (or structural relations) of the cells they become composed of, and would inevitably in time become visually imperceptible. (The whole of those variations is the general statement of the "bending" of light rays, of which Einstein's predicted instance is merely a special case; §66. Obviously, I have described them in terms emphasizing affinity.) —— As an example of that wearing out of light, if the ray hit some C atoms in the form of soot the ray would rapidly become imperceptible; if it traveled through the comparatively tenuous, but structurally analogous, galaxies, it would travel far enough to permit us to see a few layers of galaxy whirls. That theory agrees with what we do see. Reynolds calculates that a light wave is reduced to $\frac{1}{8}$ its primary energy after traveling 56 million years. So it is a reasonable guess that ordinary light would remain rather definitely visible for a travel of a million years through galaxy structures such as ours, and that might make as many as 50 layers of galaxies visible to us.

c. The last paragraph is the mechanical summary of light. It is obvious that it is *in effect* directly equivalent to the orthodox theory of light, but is logically rather different. I. e., the orthodox theory substantially says that light is the vibration of a geometrical point in the transverse directions—a point of ether perhaps, having no mass, but thus vibrating against enormous (effectually infinite) resistance of a solid, elastic ether;—and that comparatively the longitudinal or normal resistance to travel is so small that there is none, so that the wave theoretically orthodoxly travels on forever, although the orthodox theory does not call that longitudinal component a component of the wave. Further, in that orthodox theory, it is obvious that if that point thus vibrates, it can propagate itself only by acting on the next point; but evidently, if it moves up to the next point it must occupy identically the same space as that point; or, if vice versa it makes the next point move by moving away from it, then there is left an absolute vacuum, not even filled with ether, and there is no way of getting the asserted reaction across it. It is therefore obvious that the orthodox theory of light is continually confused by its unsolved One and Many; and by its efforts to talk in or of absolutely separate dimensions (i. e., to say that a wave is absolutely only transverse vibrations—or, even worse, an orthodox plane polarized wave is only 1-dimensioned), destroys itself and its classic logic continually, and gets numerous purely religious conclusions that we notice from time to time. —— Now, all that I have done is to sum all those orthodox verbal difficulties, get the logical method which obviates them, and then consistently describe a cell (§§97-8) which *will* vibrate without again

introducing the verbal conflicts. That cell obviously gives the 3-dimensioned components properly and self-consistently combined, and we always have 3-dimensioned light and none of the orthodox confusion. But obviously, I do not substantially change any of the orthodox theory. I merely use a consistent verbal trick and make that theory intelligible, in the sense that it is no longer continually self-contradictory.

d. However, it appears at once that because we do actually use a *finite* body as the basis of light (and thus always omit explicit expression of a part of the infinite regress of dots), we are not actually talking an absolutely continuous language (which the orthodox theory pretends to do), or using an absolutely continuous theory. Of course not; it is not possible to do so in a finite time. So we have adopted a *practical* method of using a so-called continuous theory: i. e., we take a continuously moving (i. e., elastic) body of a certain size, and verbally ignore the inner structural details of it (the orthodox theory *actually* ignores the inner structure of the *whole* ether). So it then clearly follows (and it can be seen to follow from par. b) that we shall be forced to reject from such a *positive*, pluralistic science or theory all the religious or mystic expressions. I. e., in dealing with any finitely perceptible light, there is no such thing as (1) a constant speed of light anywhere, or (2) a simple or compound harmonic wave motion in a geometrical sense, or (3) normal dispersion, or (4) plane polarization, or (5) any other "perfect" phenomenon. All actual or experimental light phenomena are the inseparably connected 3-dimension vibrations of par. b, and in no case can any of the three components become zero or infinity—although any or all may at times become *imperceptible*.

e. Our elongation or vibration of cells is formally or logically contradictory to secondary whirl formation, of course. It is deliberately so; for in order to agree with conventional talk, we have agreed to *change* our form of talk, and instead of saying 'secondary whirl formation' (which produces at least one *definite structure* or dot in addition to the original structure), we say 'elongation' (which *continuously* retains the original structure, which now however becomes explicitly variable in itself, or *implies* dots in infinite regress). —— Obviously, a long continued or *repeated* process of secondary whirl formation produces an elongated spiral nebula (i. e., one stretched out or elongated in the "transverse" directions, and correspondingly flattened in the direction of its travel—in the direction PP′, Fig. 107e); *then*, a longer continuation of the same processes turns that spiral nebula into a cluster in which those long transverse directions shorten, and the other dimension increases. Hence, the *sum* of the processes of secondary whirl formation may be expressed, in a *contrary form* of language, as a vibration; *for the sum actually is vibrations:-* i. e., the nebula stretches out sideways and then shrinks in that filiar plane and stretches out in the third dimension. We thus violate every explicit rule of the classic logic, but actually keep consistent by using our solution of the One and Many. The orthodox assertion of a vibration also violates the classical logic—and then makes matters worse by denying that it has done so (cf. description of 3rd quadrant curve, Fig. 104b). —— So to sum up, when we have whirls *small* enough (an unessential matter of space) we see them go through all the nebular stages with corresponding smallness of time, and call the observation "light." Therefore, to a larger being, to whom our galaxy is an ether cell, the history of our galaxy in the last chapter, from its arbitrarily assigned beginning to its present stage, is the history of one-fourth wave length of light from it.

f. The remainder of light consists of stating the relative proportions of those three components of light in collections of cells or bodies under varying conditions. Obviously, if we made a statement of such proportions for all the bodies in the universe, then we would have described the universe as light.

§126. a. The general principle of asymmetry of cells may be put in modified terms of Huygen's principle (§§124d, 125b), as one way of expressing Bernoulli's principle:- that any cell has asymmetry of motion in the three directions of elongation (by the theory of commensurability, §50), and so truistically becomes the center of elongation of the surrounding cells. We are going to *apply* that principle to cells: doing so will actually be equivalent to the application of "larger" asymmetries to secondary formation, which was done as the whole of the last chapter.

b. We may for convenience adopt a more explicit symbolism for light velocities. We write V_1 for the average velocity of light in our neighborhood (about 187,000 miles per second, or 3×10^{10}cm/sec). The lowest speed visible light is red, and we may write its veloicity V_{1R}; the highest speed, violet, or V_{1V}, etc. We may write a speed anywhere between red and violet as V_{1RV}, etc.

c. I have been saying that an ordinary visible atom would have a filament difference surface (or some important difference surface or surface) at the approximate speed of light. As will appear, a more explicit and precise statement would have been that the difference surface had a speed such that it produced the *radial* elongation which had an effective speed of light. It is convenient to continue to say briefly that surfaces of visible atoms in our neighborhood have a velocity V_1; I do not know what the varying three component cell speeds are in various circumstances, as it is a mathematical problem I have not tried—a part of the general theory of harmonic periodicity. See Reynolds's and Erwin's book for useful hints as to the methods of working it.

d. Since the vibration of a cell on that atomic difference surface consists of the nebular processes or stages of a galaxy whirl (§125e), it is apparent at once that the component elongations in the three general directions are never a simple harmonic motion in any one of them, as is substantially held by orthodox light (see Wood's "Optics," 5-8, for a short statement of the orthodox theory, and of the nature of simple harmonic motion: briefly, it is oscillatory motion (1) in a straight line (2) with perfect rhythm—two perfections that are absolutely impossible in any actual phenomenon). We can see that the *speed* of elongation considered separately (resolved) in each of the three directions rather rapidly reaches a fairly steady value which it maintains until the reversal of nebular form (until the spiral begins breaking into a cluster, usually by rubbing cohesion or collision with another whirl—which completes half a wave); then, the speed of elongation becomes again comparatively rapid ('reversing' or changing algebraic sign or direction), and takes up a rather steady value of the other sign. In short, the speeds of vibration never are represented by the orthodox perfect sine curve, or any finite compounding of such curves; always actual light, as seen by the direct analogy of that cell to our galaxy, is represented by an infinitely compounded sine curve which, as just seen, would ordinarily be a rather flat-topped sinuous wave. The one ray which comes of this cell we are discussing has not so far as I know ever been perceptibly observed to be of more than *one* longitudinal or normal speed during a time sufficient for the passage of one wave length—i. e., to be of more than one color. That fact (that one wave of the ray appears to be of one color, whereas obviously theoretically it is not) of course tends to show that it is represented by a somewhat flat-topped curve. But, as just implied, it is clear that every actual ray of light contains in itself the complete gamut in infinite regress of different light

—light of varying intensity in different L and T parts of the ray, with limits of longitudinal speed ("color") from 0 to ∞, and limits of transverse speed ("intensity," which depends upon *amplitude*:- the length of such transverse elongation) also from 0 to ∞. So a single ray—a single cell—has or is or gives all possible light phenomena. But our *perception* of light simply sums light from numbers of cells into an average condition; and in experiments our perceptions are hence too coarse to perceive that complete phenomenon just described. But it is obvious that, although as usual the poets first observed and stated that general truth (the truth expressed here in the form that everything is exhibited by anything, even by an ether cell; the poets expressed it by saying that the see-er could construct a universe from a grain of sand, or by the remark about the flower in the crannied wall, etc.), still they were crude, vague, and coarse (except rhetorically), about it, and only a careful scientific investigation and rigorously precise statement gets at all the truth in its full One beauty. —— No doubt a first class poet would improve the weird rhetoric of this fearfully condensed paragraph, and move the reader's emotions more.

e. It truistically being hopeless to try to talk accurately of those three components of elongation of a cell (as one cell exhibits the infinite regress, and for accuracy would require an infinity of words), we shall at once proceed by mentioning only the characteristic or more effective parts of the components and implying the rest. A given cell on vibrating with three components would obviously tend to set all the cells around it vibrating in turn in the same way, following the general principles of harmonic motion (modified by the fact that such motion can not be perfect).

f. The amplitudes of the elongations in the transverse directions are held in check by the structure, as seen. Or, what is the same, when those components travel out (by the law of action and reaction) in all directions from the first cell as a center, the structure makes the ether substantially a solid, so that as the ultimate limit, the amplitude of vibration of a single given cell has decreased as the square of the distance from the central cell—that being the same as saying that the total transverse elongation of all the spherical shell of cells remains the same (that assumes the medium to be practically homogeneous). Or, the intensity of light, as a One limit decreases as the square of the distance from the source, assuming that it travels in dynamically homogeneous cells, and that the cells have negligible size—both of which conditions are never actually met with. It is usually orthodoxly stated that the amplitude of a *wave* decreases directly as the distance increases; but that amounts in practice to what I have just said above, because I am not talking of the orthodox *abstract* (really mystic) waves which actually never exist, but am talking of changes in particular cells, which changes are various units of *Energy*. Then, as a sum of this paragraph, we have our equation $That... \times This... = Energy$ turned into the form $Intensity... \times L... = Energy$, where the structural unit is a cell, and *Intensity* is elongation in two directions, or really $L \times L$, so that the equation amounts to $Unit\ M(L... \times L... \times L...) = Energy$. And as those L's imply T, the light equation is obviously truistic with the various forms of the measuring member, and with *Energy* (IX).

g. In the last paragraph it is obvious that in order that there may be such a solid structure, so that truistically the transverse components as they travel out may vary inversely rather accurately as the distance, we must consider the original normal direction as continually changing so as to *keep* normal to the whirl flows as those flows vary in direction. Or to put it perhaps more intelligibly, if we tilt the transverse directions as may be necessary to keep them always cutting rather perpendicularly across the whirl stream lines as the wave travels, then the transverse components will vary rather regularly, and we need not pay much attention to them but substantially describe light by describing the changes in direction of the normal component, the path of the ray (the chief exception to that is polarization; §130). So the last paragraph is almost all we need to note about the transverse components. In the equation *Intensity* is of course not orthodoxly steady; it needs the dots that were explicitly written. But our chief emphasis is on *This...*—on *L...*, the ever varying path of the ray. —— Now, curiously, but in accord with the psychological principles of verbal balancing (§155), orthodox theory asserts that light is *only* the transverse components, and that the path of the ray is not light at all. But the theory then, in order to describe light, does practically what I propose to do here:- describes the path which it says is not light. —— We have, by the foregoing, decided that it is more convenient to decribe light by having the radial direction continually shift so as to be actually the main axis of the light-whirl (i. e., the whirl that would be corpuscular light), which we have seen points in the varying direction in which the whirl moves except for the spiral modification (cf. the path of S, Fig. 107e). It then follows that the radial component of motion of the ray travels by vibration in the ever-varying direction at ever-varying speed. We begin the examination of the details of that.

h. An identically equivalent way of reaching the above conclusions as to the path of a ray is to consider that as the three components travel out from the central generating cell, they dynamically combine with analogous components in other cells by the third law of motion. That way is the orthodox way: but it involves a painful amount of direct contacts with the verbal difficulties of the One and Many—as may be readily seen from the textbooks.

i. As constituting the typical light phenomenon, we may consider the radial component to have arrived at the next outward difference surface beyond the one at which we may arbitrarily take it to have started, and note the results. —— If we are considering a simple fluid whirl, ignoring possible condensations, the cells in that next surface will have a slower speed of elongation, and also will have their axes of radial elongation at some finite angle to the arriving elongation. The result will in general be that the ray will travel through, but will then travel at a slower speed and in a different direction. —— I have expressed that as if the ray suddenly changed. But obviously that change took place gradually throughout the ray's path, and the difference surface is merely a *zone* in which gradually (i. e., not instantaneously, and not in zero space) a different gradual change, due to the *next* field which the ray is then entering, can be considered to *begin*. So for brevity we may speak of the difference surface as the place where the summed change occurs—as otherwise we would attempt to express an infinite regress; and as there another sort of summation starts.

j. That general phenomenon is inclusive of all specially named light phenomena except polarizations. In those last, it is further perceptible and expressed that at the difference surface (as the end of the summing) the transverse components are also in some degree rotated (also, they are changed in energy or amplitude, producing rotary dispersion). We consider transverse changes in §130; that dispersion in §129.

k. Obviously, it is not possible (except by the impossible one chance in infinity) for any ray at such a difference surface to have any component entirely destroyed (or made infinite), or revolved exactly 90° or 180° (or some integral multiple) thus exactly changing places with another arbitrary component. It therefore follows directly that any difference

surface roughly 'bounds' a process which has gradually taken place and is there 'consummated,' which process involves in some degree *all* the phenomena of light. (That is merely the truistic reverse form of our general statements in Part One that the convenient practical method we use for splitting the universe into parts is to do it at the places—surfaces—where *our* light phenomena "start"; we are now seeing that in a direct and experimental way.) —— That is true even though we neglect all but the average values for the components that started out to travel through the structure to the next surface. So when below any given light phenomenon is named, that implies that all others are happening with it. There is nothing strange about that (it applies to any sort of phenomena we can name):- an ether cell is a stellar galaxy, and obviously every possible kind of phenomenon is happening *in* the galaxy, and hence when the galaxy is thus summed up as light, and stated in terms of light, truistically all those kinds of phenomena are included.

l. Also, even though we start from one cell which is giving practically one color light, adjacent cells will unite in forming with that cell a sum giving slightly varying components in the ray—in any given cell in the outer difference surface. Hence, that cell in the surface will exhibit a continuous spectrum—perhaps perceptibly so, as we shall see.

§127. a. The last section gives a broadly detailed mechanics of light in conventional terms, making no more variation from those terms than logical consistency imperatively requires. However, even if they are conventional, they are hard to understand. So I now give an equivalent unconventional expression of the same thing, which although rough, is intelligible.

b. Let us consider two adjacent solar systems in the galaxy. They would then be in fair equilibrium with each other, and would have a fairly balanced solar field difference surface between them (more explicitly, a field surface for each, with a little of the galaxy field between them, the sum

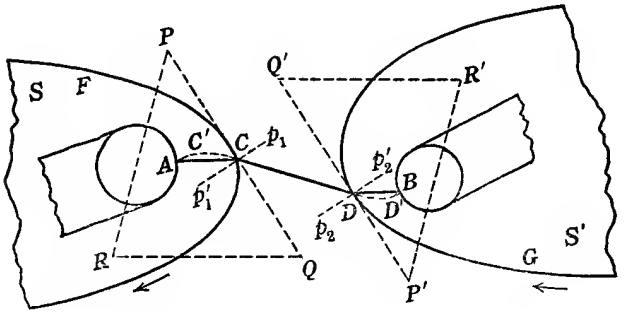


Fig. 127b.

of the three amounting practically to saying that there is a common, somewhat balanced single surface between). Let Fig. 127b roughly represent those conditions. S and S′ are parts of two whirls or solar systems in cross-section. A is a cell on the filament surface of S, and B a cell on the filament surface of S′. As S and S′ are taken to be approximately in balance, it follows that the spiral motion in their differeace surfaces (FC and GD) are 'reversed' or 'opposite,' and about equal, as is roughly indicated by the two arrows. So for arbitrary clearness we may draw them as in the figure, with some of the galaxy field between—although as a matter of fact that part between the surfaces is merely an additional thickness of the field difference surface that is common to the two whirls. (That surface has *some thickness*; hence it is desirable to show in the figure an appreciable thickness, and the method used is equivalent to doing so.) Now, as light travels out from A towards a point C on the field difference surface of S it constantly encounters a weaker field, compared with its radial component: hence, by Bernoulli's principle, Huygen's principle, Newton's third law, etc. (all are equivalent), the ray travels in the *curve* AC′C, which continually increases its angle with p_1p_1' (the perpendicular or normal to FC at C)—thus arriving at the surface FC headed in such a direction that its transverse components are in about the same plane as the similar components of the cell at C; that thus makes it at least nominally the same ray of light that started (i. e., it is its dynamic result). The ray would pass through the thickness CD which was arbitrary, in the therefore truistically necessary arbitrary straight line CD to D—that line CD being tangent to AC′C at C (i. e., it is simply a continuation of AC′C—a geometrical verbal counter; see par. d). Then, at D, the conditions being reversed, the ray would travel in the curve DD′B (the dynamical reverse of AC′C) to B on the filament surface of S′, the beginning of its curve being tangent at D to CD. That is the identical *summed* result of the path of a ray by orthodox light, when it passes from one medium to another (assuming that "*all*" of the ray passes the boundary, as of course is not the case; i. e., the cell at C is 3-dimensioned, and obviously some of the energy or components of the ray is absorbed, some reflected, etc.—including all of light phenomena). As a *sum*, to agree with orthodox summations into monism, we have the fields on an *average* dynamically denser than their field difference surface. Then we could, by such summations, take it that A was a point inside the dense, practically homogeneous prism PQR, which prism is as shown tangent at C to the surface FC; and B is inside the similar prism P′Q′R′ tangent at D to GD. As the fields were dynamically (roughly) equal, the prisms (assumed of equal refractive power) would have their sides PQ and P′Q′ parallel, so that the summed ray would be the broken line ACDB, made up of the three straight parts shown. As indicated by the figure, that ray is the orthodox ray (see Wood's "Optics," chapter on refraction).

c. I shall not go into the geometry of the amount of that refraction—deviation—of the ray. It is simple: all that needs to be noted in going into this thoroughly is that when I put a space between FC and GD it was thus tacitly assumed that the two fields were made denser dynamically than that symbolic space, so that AC′C leaves A dynamically bent from its average direction—and so on, similarly. The general reader needs simply to observe that all rays traveling in the universe, in any way, are *continually* being curved, and that we seem to see things as if they were in the direction of the tangent to that curve where it enters the eye. Orthodox theory of light roughly asserts that light travels in broken straight lines; but even that theory admits, in order to agree with observed facts and actually in contradiction to itself, that no reflection (e. g.) does take place exactly at a geometrical surface:—that admission is obviously identical with the general principle of no straight lines which I have just asserted, and which is proved by this whole book.

d. Hence, at A, B appears to be in the direction AC′ (or accurately, in the direction of the tangent to AC′C at A), and the angle of that deviation from its true direction in the straight line AC is in astronomy called its aberration. But this sort of aberration (as shown by this figure) is not definitely recognized conventionally, as we shall see. (The true direction of B from A is AC: for if I had not arbitrarily put in that separating space, C and D would of course coincide, and ACDB would then be a straight line; but the space had to be put in to show the theory well, as we shall further see.)

e. It follows that everything in the universe appears slightly displaced to us—i. e., it follows, except in the one chance in infinity that our finite eyes are in *exact* dynamic

balance with the observed body. But that displacement is essential if we are to see it visually *clearly*, and not with more or less colored spectrums for boundaries. For obviously, *all* colors actually travel from A to B or from B to A. Hence, instead of there being one path AC′C, as shown, each of the infinite number of colors, because it has a speed of its own, would travel to the field surface in a path of its own, and there (as a truism of such paths) spread out into a spectrum: then, the equivalent to the reversed prism (*practically* precisely reversed, as the whirls were taken to be in fair equilibrium) would recombine that spectrum, so that it reaches B practically all together, and it therefore *seems* that all colors travel at about the same speed, in "free" space. Obviously they do not, *anywhere*; but are *always* dispersed fan-like into a spectrum and then, because all objects are usually fairly in balance, are ordinarily perceptibly brought together again *at* the object to which they travel. Each color thus travels at a different speed all the time, but has traveled over a *path* that is proportionally longer as its speed is greater, so that the colors arrive practically together ordinarily. Numbers of men have elaborately observed that colors ordinarily arrive practically together, regardless of their origin in "free" space; hence, some have irrelevantly concluded that the colors must travel together at the same speed, as it seems not to have occurred to them to consider whether all colors traveled over the same path. They tacitly took it for granted that all light travels in straight lines, whereas the absolute principle is that none ever does, finitely speaking.

f. S and S′ can not be in *exact* equilibrium, because as a truism of their existence, in the language we are speaking they are in mutual motion. Therefore, it is impossible for all the colors of B to arrive exactly simultaneously at A. Or to state it otherwise, there is *some* degree of asymmetry at C or D, and hence the spectrum which is spread upon the field surface at that place can not be *perfectly* united at A. It is obvious that ordinarily, in conditions of fairly steady balance, there would not be much variation of color at A from its condition at B; and as the colors kept on coming continually from B, any slight retardation of one color would merely result in giving an apparent different color to B from what it would have been if the balance had been more exact (i. e., the actual spectrum of B at A is so slightly spread that we do not notice it as a spectrum, but merely as a slight change in color; see below). But obviously, if we now consider B to be a rather large astronomical body and hence giving off light made up of a mixture of very perceptibly different colors; and if it were in close orbital motion with a companion which would eclipse it, then we could see the colors start to come. And B's *orbital motion* would also obviously cause quite considerable *local* asymmetry of B compared with the steady whirl S, and hence would tend to give perhaps a perceptible separation of the colors if we were at A observing B come into view after an eclipse. The whole tendency would be for us to *perceive* some of the colors "catching up," or becoming stronger after a time. Such phenomena have been actually observed:- Tikhoff and Nordmann independently observed a mutual variation in the speeds of different colors in so-called free space from such a source in that way. That is obviously crucial proof of the consistency of the foregoing.

g. It at once follows that all that is a description of the principles of a *complete* sort of *aberration*, and that it is not possible to measure complete aberration (it is an infinite regress: that is another point of view of no exact science, and I shall not explicitly expand it into truisms). The actual aberration which we do note is only a part of the total aberration described above. What is conventionally known as aberration is the angular displacement of a heavenly body from the line of vision in which it appears to be, and is due, if we interpret conventional descriptions explicitly, *only* to the earth's spherical field. Aberration in the complete sense in which we shall use it is due to *all* structural variations. Such general aberration as a matter of obvious fact is practically negligible for us for all fairly balanced things in our environment here (where the unbalances are great—e. g., as between lenses and air—the phenomena are given different special names); but aberration for celestial bodies is perceptible. The earth's spherical field is in fairly good balance with all other fields (but not in exact balance), and so gives an aberration of any star, as in Fig. 127b, at any given time. Then about six months later we are on the opposite side of our orbit about the sun, in reverse balance, and hence the aberration of the star is practically reversed (or the star appears to be twice the angle of the spherical field aberration from its former position—neglecting the modification of its aberration due to the ether structure in the distance across the orbit of the earth when that distance more or less intervenes; that neglected part includes much of the aberration in the infinite regress of it, as is implied in the next paragraph; e. g., the "bending" of light near the sun predicted by Einstein's relativity theory is a special part of aberration due to the sun's spherical field—when thus put in terms of affinity; see §125b and the next paragraph). —— In brief, the *transverse* motion of the earth relative to the star, by Bernoulli's principle, makes its spherical field the equivalent of a prism. The *radial* motion of the earth relative to the star is provided for by Doppler's principle ("Ency. Brit.," ii, 818). It is obvious that we could take aberration and Doppler's principle as two factors giving the One or *Energy*, and completely express—explain—the universe with them. All that is omitted here. Obviously, this description of aberration is merely the description of light from the point of view of its being received at a body; that is simply the reverse or vice versa of its description in the last two sections from the point of view of its formation at a body or ether cell. Also, it can be seen that by following ordinary language we get bent light by ordinary principles as to structures in ordinary steady space.

h. Clearly then, what is usually named aberration is simply the refraction of a celestial body's light that is due to or accomplished by the earth spherical field. The complete aberration of a given body in another galaxy would have that refraction by our spherical field as the first [or last] part of itself. The next part of that body's aberration is due to our solar whirl field—and could be measured by us if we observed the body's direction from opposite sides of the solar system's orbit about the galaxy axis, taking into account other changes. Also, there would be another part of its complete aberration if we had to view it through the sun's spherical field: obviously the light from the body could not come through that field perfectly symmetrically, and hence there would necessarily be some degree of deviation of that light due to that field (that being another statement of Einstein's "bending"). And in the same way there is a part of the total aberration added by every difference surface encountered (more precisely:- by every field and filament passed through). It is obvious of course that if we look at such a body one part of that total aberration is *usually* in a sense opposite to the next, so that the path of the light from it is actually a sort of wavy, corkscrew line (we saw that a whirl corkscrews itself along; we now consistently see that light, regardless of whether described as waves or whirls, does the same); and the aberration due to our spherical field is *practically* all there remains of the body's aberration over that algebraic nearly zero—but possibly the aberration caused by

the sun's orbit about the galaxy axis does not perceptibly cancel out. Of course, the One absolute sum total of the complete aberration of every body is obviously 0 (or arithmetically, ∞), so that qualitatively aberration, as a rigorous truism, does not keep us in ignorance of anything but unessential temporary quantities. Clearly, however, it theoretically would require infinite time to measure the complete aberration of any star accurately.

i. It thus obviously follows that the consistent way of describing aberration is to have the ether around the earth form a structure that accompanies the earth. It *could* be verbally described with valid logic in the opposite way; but that would give all the enormous verbal difficulty that would accompany Ptolemaic astronomy (§100c; *has* given the relativity theory as one such method). Hence, as we have been seeing, in ordinary language the ether accompanies the earth.

j. In effect the Michelson-Morley experiments compared the velocity of light under practically identical conditions, except that (1) in one case light moved in the direction of the motion of the earth from a point A to a point B and back (those points being places on a large stone disk), both A and B being considered as moving with the earth, and (2) in the other case the light moved across that earth-motion in that same path. If the ether does not move with the earth (or the apparatus), then it can be shown by simple geometry that it would take more time for the light to make the trip across the earth's motion; if the ether moved with the apparatus it would make no difference how the line from A to B is oriented (assuming, as is practically the fact, that the earth field structure is practically homogeneous in that small portion of it). The experiment showed that it made no perceptible difference—that within certain measured limits the ether was dragged by the earth. See Wood's "Optics" (XXII) for the details and for other details of orthodox light mentioned in this paragraph. —— We have just seen that a consistent description of aberration agrees (if we use ordinary language) with that. As stated in §124g, it is orthodoxly considered that aberration requires a still ether; it is orthodoxly held that *all* experimental evidence except this Michelson-Morley experiment requires a still ether—one not dragged by atoms (which orthodox view about atoms shows clearly that orthodox light makes a dualism between matter and ether—that the fundamental difficulty it has is that it makes no explicit solution of the One and the Many). It is now obvious that what orthodox theory requires is an explicitly expressed difference surface: for we saw in pars. b-d that the so-called still or free ether which was required was merely a formal counter of actual—not zero—space between prisms (which prisms the orthodox theory assumed with logical inconsistency to be perfectly homogeneous or isotropic). (Obviously, those two orthodox absurdities—absurdities from a finite point of view: religiously or mystically they are all right—do cancel each other, and give a theory that is logically consistent, but is so only in one zero point.) —— In implicit proof and agreement with all that, Lorentz undertakes to show that the Michelson-Morley experiment can be explained by asserting that there *is* a still ether (as is orthodoxly supposed to be required by all other light experimental results), and that the stone disc which fixes or gives the length AB is shortened somewhat by passing through that still ether, so that the actual path of the light is shorter—that then being [superficially] verbally consistent with observations. That direct assertion is obviously equivalent to saying that matter which measures space varies as such a standard, so that *space varies*: and those ideas of Lorentz's are the base of Einstein's work on relativity. —— Well; obviously, if the stone is shortened by rubbing against the ether, then the reaction asserts that parts of the stone move some, and that of course requires that the ether must also move; for it would obviously be an absolute miracle, *using our language*, (a flat self-contradiction) if the atoms and ether thus reacted without causing the ether to move—to react, to be dragged. (If the language be changed to the relativity theory, then in that new language Newton's third law is not so—for if space thus changes in order to avoid that reaction asserted by that law, then that third law does not hold in the new language.) —— Hence, to shorten the path (even by the relativity theory itself) is identically the same as saying that the ether moves. And obviously, by our method of putting the ether into a structure we show the character of the narrow or more or less *nominal* problem of whether the ether "moves"; for it is then at once evident that the structural relations consistently describe *all* light experiments, and it is entirely immaterial (from the point of view of the total truth) whether we use the verbal form "ether moves," or the formula "ether does not move." The everyday custom of speech is that the ether moves. The orthodox theory means precisely the same thing, but puts it mystically—not scientifically, or finitely.

k. U. A. Boyden a number of years ago entrusted $1000, now known as the Boyden premium, to the Franklin Institute, to be awarded to "any resident of North America who shall determine by experiment whether all rays of light, and other physical rays, are or are not transmitted with the same velocity." In 1907 part of the accumulation was awarded to a man who was believed to have shown that certain different colored light rays were transmitted at the same velocity in "free" space, because he showed that they arrived here practically together after starting out practically together. We have seen (par. e) that that solution is wrong in that it is quantitatively inaccurate and qualitatively totally irrelevant. So far as I know the premium is still offered, so apparently the problem is still unsolved, apart from this book. Here we have the complete solution (cf. §§124-6).

l. The solution of those recognized outstanding problems of light is comparatively incidental. The important application of this roughly stated section (the section is so condensed that precision, and some intelligibility, had to be sacrificed) consists of showing how the spectrum is formed. Knowing that, then we can readily find the details of structures of different sorts of atoms, and be in a position to find out qualitatively (and quantitatively, in so far as actual measures have been made) why certain atoms have certain properties, and how to use those properties—in short, we have a rational basis for all engineering problems, chiefly in terms of "chemistry." So we start investigating that spectrum; it will have to be done briefly, and hence roughly.

§128. a. We shall go at the formation of the spectrum backwards, so to speak. I. e., we start with the different vibrating structures and see how they add together their effects as a final spectrum, expressing the mechanics in terms of light. So that we may have no difficulty in forming a clear conception of a spectrum—no difficulty in verifying the mechanics by observation,—I shall show how our galaxy as one atom will form a spectrum for a larger being, for whom the cells in the surface of our galaxy filament have a velocity of radial component that gives him visible light. To him, therefore, our galaxy would not be large enough to be perceptible if it is alone; so in order to avoid verbal complications let us assume that it is in a collection of similar 'atoms,' so that the same sort of light will come from each, and add together by Huygen's principle to form an ordinary so-called flat wave-front. That simply means that if we take it that light is corpuscular, then two of those whirl

corpuscles can not occupy the same space simultaneously—a truism. In terms of the origin of vibrations it is the same principle shown in §126:- that the radial component changes direction. Or it means substantially the same as the orthodox theory which shows that each newly vibrating cell becomes the center of light vibrations, and that by "interference" light is propagated "rectilinearly," and hence in "wave-fronts." That orthodox theory is well known (Wood, "Optics," II), and I omit further details of it. I shall call the results of Huygen's principle the composition of light, composition of components, or results of interference.

b. Then, omitting all other details of structural insides of our galaxy, it is obvious that its filament will tend to form in the galaxy field surface a continuous light spectrum—i. e., the infinite number of colors will tend to spread out as a continuous spectrum on that field surface, as we shall see in more detail. But obviously, we must consider interference of light from various parts of the filament surface. If the filament were perfectly symmetrical and the field surface perfectly symmetrical, obviously there would be total interference, and we would get no light: or, we could equally well say that each ray would then be totally reinforced, so that there would be infinite light—both being One statements. So it follows that in our galaxy, which is not symmetrical (and remembering that we are ignoring all structures but the filament and field), at any place on the field surface there will be, as a result of what has been described as aberration or what is usually called refraction, a continuous spectrum, some *bands* or portions of which are 'brigbter' than other parts (that 'spectrum' is not what we see and conventionally name a spectrum; the latter is the reflection of the 'spectrum' of light waves from a screen, body, surface of our ordinary atoms; as we are interested here in the dynamics of the light wave we may use *spectrum*, etc., to name the condition of the waves). The darker parts of that spectrum at the field surface are due to interference of rays from other parts of the filament surface which have been "passed" through that part of the filament surface which is forming the bright bands (or vice versa, depending on relative conditions). —— The field surface is obviously fully 'overlaid,' everywhere and in every direction, with those complete spectrums; the *place* on the field surface at which we would say a particular spectrum is located would depend upon the relative location of the viewing point (analogous to the location of a rainbow; this *is* a rainbow I am describing except there are 'self-luminous' and refracting continuous ether cells instead of drops of water). Hence, as each of us (or each of those greater beings) has his own point of view in seeing or describing that spectrum, each of us would have *his particular spectrum* on that surface, specially oriented, and differing somewhat from all others' spectrums. Our description has here merely run into the infinite regress; we shall get out of it with but negligible difficulty shortly.

c. We therefore see that a complete or continuous spectrum, having more or less perceptible darker bands, is the spectrum of the newest, youngest, or most fluid whirl—a whirl which has negligible secondaries and condensations. It is called a band spectrum, and is orthodoxly considered as being made of bright bands separated by dark bands; obviously, there must be some light in the "dark" bands, or else we have a zero-infinity error. It is further obvious that *every* finite band in the spectrum, however narrow it may be, is *itself* a complete spectrum of the same sort overlaid on the wider spectrum, coming from a structure of different order. Or, we may briefly call it a different order spectrum. Obviously, such different order spectrums, truistically with different order whirls, will extend in infinite regress.

d. It therefore follows, that because the cell from which any given band (regardless of how nearly zero in width, or how nearly infinite in width, the band is) comes, is taken to be of *finite* size (when we are using scientific language), then there must always be a certain fixed ratio between the sizes of those bands, or between their spacial separation (which is the same in principle), depending upon the finite size of cell which we originally take as a criterion (we ordinarily take a cell with vibration at V_1 as standard). Therefore, the proportional periodicity of structure is seen to inhere in the periodicity of spectrum bands (or spectrum *lines*: a comparatively narrow perceptible spectrum band is customarily called a line). That ratio would obviously be somewhat approximately proportional to the inverse square, on the same principle as Bode's law (§117). And that ratio is observed to exist, the assertion of it being known as Balmer's formula:- *Wave length*$=h[R^2/(R^2-4)]\times 10^{-8}$cm, where for observed H lines, h is a number, 3645, and R is given successive values 3, 4, 5, 6.... That formula rationally asserts that the ratio of wave length to the other two dimensions of space (to L^2, or radius-squared) is rather accurately, but admittedly approximately, proportional to the numerical ratio $1/R^2$—to the inverse square,—but that because of the finite size of the structures R^2 has to be reduced *a little*, just as was done in Bode's law, and for the same reasons as were seen there, or just as Newcomb and others have *empirically* tried to correct Newton's law by making the inverse 2 a *little greater* number ("Ency. Brit.," xii, 384). (Also, Balmer's formula is supplemented by Biot's law; §130f. In principle the two are the same.) —— Of course, a completely rational Balmer's formula and a completely rational Bode's law would state just how much that '*little*' is, and the general mathematical theory *of its variations*—in short, would be the explicit theory of harmonic periodicity, the theory of the numerical coefficients in IX. Erwin, in discussing Balmer's formula, gives some first steps in the statement of that fully complete mathematical measuring theory of science.

e. And Moseley's law (Millikan, "The Electron," 194, 201, 213, etc.) is in principle the same as Balmer's formula. Moseley observed that "arranged in the order of increasing frequency of their characteristic X-ray spectra, all the known elements which have been examined constitute a simple arithmetical series each number of which is [*approximately*] obtained by adding always the same quantity"—i. e., by adding the same spacial distance on the similar spectrums. Now, X-rays are roughly a different order of vibrations from ordinary light, and hence a complete X-ray spectrum more or less adds itself directly on to and beyond the violet end of the ordinary visible light spectrum, with lines representing the higher order, very rapid structures in the atom. It is difficult to refract those high-frequency waves into perceptible spectra; so in the spectrums of X-rays it follows that only the principal higher order internal structures manage to give lines energetic enough to remain perceptible and constitute those simple experimental spectrums. In ordinary light spectrums numerous atomic secondaries give complicated visible spectrums. And because our atoms are energetically harmonically periodic, it follows that their higher order structures are periodic. Hence, as the method of getting X-ray spectra automatically analyzes the atoms for us by showing only the chief energetic higher order structure, it truistically follows that such periodicity would appear as Moseley's series. That is merely a repetition in concrete terms of the last paragraph; see also par. k. —— If it be desired to put Moseley's law in the form of the inverse square law, we have $l_2/l_1=E_1^2/E_2^2$, where the l's are wave lengths, and the E's are respective nuclear charges of atoms

(Millikan, "Electron," 201). As a matter of fact, Moseley's law is no more exact than Balmer's formula or Bode's law (being of the same nature, as just seen). Moseley's law runs somewhat out of step in the middle of the periodic table, in complete agreement with the fact that there the rare earths get out of step. Also, and obviously consistently, the atomic weights of elements (App. B) do not always agree with Moseley's order, which is given by what is called the "atomic number" (e. g., elements 52 and 53). For the Moseley number seems to depend upon the size of the chief or "characteristic" higher order structure in the atom, and truistically some variation in another property (say density) of the whole atom is likely to be enough occasionally to throw the atomic weight out of order, precisely as every other simple property of atoms gets out of step with any other given property. *That necessarily follows as a truism of the meaning of property:* for *property* means a particular way of considering an atom divided into parts, and so if any two properties maintained a *regular* step (stayed in step) they would be essentially identical and not *two* properties.

f. The last two paragraphs are brief statements of the ultimate nature of *structure* and *property* in terms of light, compared with all other terms. Because they comprise such numerous details they are hard to understand.

g. In order that the spectrums at our galaxy field may become perceptible, visible, to the larger man we have assumed, they unite with others of adjacent galaxies, and build up by interference more intense spectrums, that travel on until they come to, and form spectrums at, the larger difference surface that in turn incloses these galaxy-atoms (making those 'atoms' into a solid, liquid, or gas to that man, which is self-luminous). Now, if he looks directly at that larger difference surface, his eyes, being another solid in what we will consider to be a fairly steady environment analogous to our own, are in fair dynamic balance with that collection of galaxy-atoms; consequently, those spectra spread out at that difference surface have their colors recombined at his eye and he sees the spectrums as a bright body of a certain color just as we see an ordinary self-luminous body. His particular space location will determine what spectrum on that surface is combined at his eye; hence, the color he sees is never exactly the same as the color seen by any other observer, if we use ordinary language. Therefore, obviously we can assert and agree that we arbitrarily (i. e., for convenience—see that important point made by Dewey in his Introduction) propose to have verbally an *exact* science and also a verbally steady space and time, and manage rigorously to achieve that by being *exact* in naming all colors (everything would have a differently named color for each observer, and for the same observer at each different instant of time). And as the properties of bodies are not in step, such an *exact* science would formally determine the exact *relative* names or measures for all other properties in infinite regress of variability. That would be a relativity theory (of color, I suppose you would call it), essentially identical with Einstein's (as well as being essentially the same in meaning as our ordinary language), but in which space and time would formally be our ordinary steady Euclidian variety. But all color would be "curved" (i. e., would vary in measure continually, and after an infinity of varying would naturally or truistically return to the same value, or "close on itself" like Einstein's curved space), and would have time as a "fourth dimension"—i. e., must always be dated, as it varies with time, as a verbal truism. And obviously, *any* property may similarly be made the base of a relativity theory—and as we may truistically designate an infinity of properties, there are an infinity of another sort of relativity theories to choose from if our ordinary language is not liked. —— If that observer introduces any appreciable asymmetry between his eye and the difference surface, the spectra will truistically be appreciably spread out, and from his space location he sees some particular, now visible spectrum. Obviously that spectrum which he sees is differently dispersed both in relative and in total degree from its dispersion on the difference surface (because by only one chance in infinity could the prism be exactly the effectual dynamic reverse of the various structures the light had been corkscrewing through up to the time it spread on the large difference surface). So it truistically follows in the same way that the actual spectrums we see contain in them the complete traces of the dynamic conditions of *all* the materials that make them—of every structure through which the light has passed (cf. §158c). And the other general rule which we have seen is that all asymmetries in any part of the path of a ray are represented in the final ray by variations in the composition of its components, and will be indicated in some degree by lines or bands in its spectrum.

h. We shall now see the results produced in the spectrum by condensations in the galaxy whirl. Let us take our solar system as being a secondary whirl, and the earth a tertiary. Also, suppose that the observer is stationed somewhere near the north galactic pole. One of the cells that we have been considering to be on the galaxy difference surface and to be the vibratory, arbitrary beginning of one ray, is by our definitions a lower order whirl of the galaxy whirl, just as the solar whirl is a lower order whirl. The only difference in the resulting light phenomena of those cells and of the solar whirl is that we have considered the cell phenomena as being practically continuous (ignoring inner structures):— that is consistent in principle; quantitatively, there is probably such a great difference in the order of solar whirl and of cell that the 'light' from one would be practically totally imperceptible by any means that makes the 'light' from the other perceptible; the reader should bear in mind that I am making such vast quantitative discrepancies in this discussion of light—deliberately, as a *temporarily* useful counterbalance to the narrowness of the texts. —— Now that we consider the solar whirl explicitly we shall see some detail of its inner structural results in the complete spectrum made by the solar whirl—which is a band or line in the galaxy spectrum.

i. A complete revolution of the solar whirl or system about the galaxy main axis is obviously one vibration of the galaxy lower order structure which the solar system constitutes. Clearly that vibration is a small asymmetry compared with the total galaxy; but it *is* always at a given time an asymmetry. And obviously, that continual asymmetry, fairly steady in all its temporary values, will steadily refract or aberrate the ray which goes from the solar whirl to the final spectrum. In each revolution the asymmetry obviously reverses direction, and hence the aberration would swing back and forth across a mean value and make a narrow line or band in the spectrum (that 'vibration' lasts probably some millions of our years, and would not "persist" in our retinas as a "band": but I am using the time and space scale of the larger man).

j. *Inside* the solar system there are bodies which will again repeat that process (and bodies inside those bodies, in infinite regress). The sun has a small revolution about the solar whirl main axis. And in the same way as before, that revolution of the sun will make a still narrower band on the narrow band that is the spectrum of the system itself (I am not at all sure of the correctness of that quantitative assertion; it sounds neat, but it is a problem in periodicity I haven't worked). But the earth would obviously be vibrating asymmetrically in the solar whirl field in a way that

is dynamically different from the asymmetry that is the sun's revolution. So the earth also would give a line, less intense, and separated from the sun line; i. e., no two internal bodies or structures can ever give two coincident lines. That is equivalent to the truism that no two bodies can simultaneously occupy the same space. So we have proved generally that every structure in the universe is represented by a line in every spectrum. Of course, quantitatively most of those lines in a given spectrum are very close to zero in every respect, and hence are imperceptible; and the fact that there is directly observed to be no fixed, sharp, constant line in any spectrum, especially when the conditions of the body producing the spectrum are considerably changed, is hence now direct crucial proof that there is no exact science—that mass varies with velocity—of the general argument of this book.

k. Whether or not the solar system makes a line inside the limits of that large observer's *visible* spectrum obviously depends upon quantitative periodic relationships. As a rather rash guess I should say that the solar system moved relatively to his own general large size so fast that it would be an X-ray band, above his direct visual perception, and that the larger and longer-enduring structures of the galaxy furnished lines in his visible spectrum. It is obvious however that the solar system is in a certain periodic harmony with those visible lines, and that the same system of ad infinitum relationships must exist in any whirl. So summing to the One, it is truistic that each arbitrarily particular line corresponding to each structure is itself a spectrum which has a set of relationships infinite in "number" (i. e., continuous), and hence identical with the spectrum that is each other line. There is then the final applicable truism that the spectrums of all things or structures are ultimately identical, but that the perceptibly *visible* part of its spectrum is for each thing different in some degree from that of every other thing, and that the intensities of the bands similarly vary. It therefore follows concretely that if a series of lines occurs perceptibly in one part of the spectrum of any given sort of whirl, then the same series can be found in the spectrum of any other sort of whirl if that other sort is stimulated in a way sufficient to make the differently located series intense enough to be perceptible. And that is merely a general statement of the principles underlying Moseley's observations and law (par. e)—or the fact that there are no absolute "atoms."

l. This section has therefore summed, as being identical in meaning with the last section—a proof of its consistency. We have seen a very rough statement of how a spectrum is formed, and of what that spectrum indicates about structure. The reader has perhaps noted already that there are details and modifications without end, which we could start on. So far I have not been very explicit about any of the ordinarily named phenomena of light except refraction (aberration) and the consequent dispersion. But the reader may now see for himself that it would take hundreds of pages to be fairly explicit about the things already mentioned. I dislike leaving the descriptions in the above rough and glaringly unfinished state; but the general reader has no special need for further mechanical details, and the professional expert can get them from the given method better than I can give them, and nearly everybody will demand that I be brief. Brevity in these days is coming to mean a jazz syncopation demanded by shallow persons; but it is reasonable to require that I condense the rest of this chapter even more severely.

§129. a. In describing dispersion above I did not give explicit proof that there was no such thing as the so-called normal dispersion, in which (to use conventional terms) it is asserted that the refractive index increases as the wave-length decreases. Conventional experiments superficially seem to show that such dispersion does exist. I shall condense the proof that there is never such dispersion.

b. The light from the filament surface in the last section (or from a vibrating cell, if it be noted that in any azimuth the cross-section of a cell is a *closed* line) will obviously be sent up to form the spectrum on the field surface from a line of cells which, taken in any plane, is curved and finally closes on itself. It therefore follows at once, by geometry which would take hundreds of words to write with reasonable preciseness but which is readily seen if you make a diagram of these conditions and happen to remember a little geometry, that no dispersion line (band, color) in the spectrum is a *straight* line—or what amounts to the same thing, is exactly the same color (lying in a straight line perpendicular to the length of the spectrum—perpendicular to the average direction of dispersion). So any spectrum, however formed, if permitted to have lines of sufficient length, will have the ends of those lines perceptibly curved, the curves fading out of visibility (there would be in each band, before it starts curving in the opposite sense with reversed direction of dispersion, a geometrical line of infinite—or zero—refrangibility, which accounts for the perceptible fading out of visibility and completely agrees geometrically with the fact that the light started from a closed curve structure). Those curves at the ends of the lines in a spectrum are perceptible in many experimental spectrums, and are called *wings*. And the degree of curvature of each wing will truistically vary with the variation in color. It is recognized by orthodox light theory that so-called normal dispersion is merely a special case of anomalous dispersion (Wood's "Optics," 95): as a fact, the details of which I omit, "normal" dispersion is a One statement of dispersion, or the $0-\infty$ limit.

§130. a. As we have seen, as a truism of the principle of asymmetry there can be no ray with equal transverse components (nor can either of those two components ever become zero). So it is obvious that always, as a ray travels along, it is encountering asymmetries which continually change the relative length or energy of the two transverse components. That is the same in effect of course as these:- (1) one component may be made so small as to become imperceptible; (2) they both may be made so; (3) a given *ratio* of the two may be fairly steadily maintained, but the continual actual change of the two is equivalent to the rotation of the two about the path of travel as an axis; (4) or those relative changes may be combined in any degree. And such phenomenon of *change in the transverse components of a ray* is named *polarization*. It truistically always occurs everywhere in every ray (it is merely the same thing as the 'spiral' flow of ether in a whirl). But it is not usually a perceptible change; for ordinary light travels through whirls which are not arranged in any very steady system (a crystal is obviously a fairly steady system of atoms; but the fluid air is not), and hence the two components are changed usually in alternately more or less opposite ways so that no accumulation of effect takes place; and hence there is said to be "no" polarization, and all the rays in such a beam of light have *approximately* equal transverse components oriented in practically the same proportions in all directions in the transverse plane. From that *average* condition (in which there is merely imperceptible polarization, although it is conventionally "unpolarized light") practically all sorts of departures into perceptible polarizations have been observed and given numerous names (see a modern treatise on optics). Obviously, there is an infinite regress of such polarization phenomena; we may name such quantitative variation forever.

b. Orthodoxly, there is asserted to be a *plane* polarization, in which one transverse component becomes 0. There

can not be any such phenomenon, of course; but we may consider that in plane polarized light one transverse component ordinarily is imperceptible. —— Then, orthodoxly, the "plane of polarization is defined as the particular plane of incidence in which the polarized light is most copiously reflected" (Wood's "Optics," 233). Then a question arises as to direction:- whether that vibration which is greater takes place in that arbitrarily named plane, or in the transverse direction perpendicular to it. Wood (ibid., 233, 242: possibly he changes in later editions; I haven't looked) asserts flatly that the light vibrations take place in that perpendicular direction. Drude ("Theory of Optics," trans. 1902, 253) says that either direction is possible, and that the perpendicular one gives simpler language; and the "Encyclopaedia Brittanica" (xxi, 933) substantially agrees with Drude. It is a question that has long been debated; orthodox science agrees that the electric vector (in the modern electrodynamic theory; XIV) is the perpendicular one, and the magnetic the other; but as I am taking the electric vector to be the filiar direction (and to be that direction only when a place on the difference surface is considered) it is obvious that this direction of "light vibration" depends entirely upon what arbitrary point of view we take (for evidently, if we take a given point of view, the *filiar* direction *relative to that point of view* takes *every* direction when the *whole* filament is considered, as it closes on itself), and that therefore Drude is correct when he asserts in effect that the directions are arbitrary and that he does not know which is the finally consistent one. We thus see explicitly that conventional science is not in agreement as to a complete set of consistent directions; and that explicitly supports §99, in which I showed that we need not dispute about directions in this book.

c. It is obvious that precisely as shown in §129b, because light is sent to a spectrum from curved chains of cells, then necessarily the transverse components must be both rotated and changed in relative value (both those changes are actually the same reaction, but it is convenient to consider the reaction from those two nominal aspects). And further:- as one monistic limit, a ray may be considered to approach being perfectly normal to that curved chain of cells, and it would then approach having a normal polarization and hence dispersion; and as the other One limit, a ray may be considered to approach being tangent to that closed chain of cells, and would approach having either zero or infinite polarization in its various aspects, and hence similar dispersions. And each effect when within the One limits would truistically be of different quantitative degree for each color. The actual phenomena are between those limits, so that all light (when it is considered with respect to its transverse components, as is being explicitly done in this section) *always* and *everywhere* actually has 'anomalous' or "elliptical" polarization, and "anomalous" rotary polarization, and "anomalous" rotary dispersion (i. e., each color is differently rotated, so that its wings curve differently, indicating again [§129] that it is not possible actually to separate the three components of light). Combinations of such phenomena are obviously indefinitely numerous, and many are named in textbooks. Volumes of mechanical details would be needed to describe them.

d. It can be seen, as consistent truisms, that those curved spectrums described in the last paragraph and in §129b are essentially in three dimensions, and that the *spectrums themselves* are *vibrations* of cells in what can be called the reverse direction from the vibrations of the cells which sent out the light that made the spectrums. Therefore, the spectrums (i. e., *any* spectrum, considering it itself in ultimate detail) are definitely the mechanical equivalent of a whirl—they *are* whirls, which by definition (as we are using continuous vibrations) are not *verbally* allowed to go further and become verbally distinct or 'fully-formed' whirls. That is to say, when we start to considering a whirl in terms of continuous vibrations, then each whirl itself is, as absolutely continuous matter, transferred, as a spectrum which *is* that whirl, to all other whirls in the universe. Or, in short, if we start using continuous language of light waves, and keep at it consistently as we have done, then the universe becomes verbally absolutely continuous and all definite whirls become definitely all *other* whirls—becoming so by transferring themselves to all others as spectrums, which spectrums turn out mechanically to be whirls. —— That sounds mystic and unintelligible, of course. And it is both—except from a One point of view. Even though I have been verbally ostentatiously declining to let go our definite, pluralistic whirl from which we started the "wave" or continuous description, we see that the waves themselves, as spectra, have become the whirl, and have made that whirl universal, or indefinite, or monistic. So by being logical or self-consistent, it resulted that the whirl disappeared as a pluralistic entity anyway (except in so far as we definitely consider those cells of which the spectrums are composed as being finite in size). So it truistically follows that for any *definite* language or science, we must use a corpuscular theory of light. Otherwise, the mysticism, or the ineffable total continuous universe, as monistically expressed (i. e., not expressed at all, in any positive sense) in this paragraph, is the inevitable result. However, the foregoing verbal trick of hanging on to a definite whirl (or cell) until we are ready to sum the whole description makes that form of "waves" scientific—for the final reason that they are formally explicitly 3-dimensioned. For obviously, all of science, before it has any meaning, must be summed into ineffable religion.

e. It is obvious further that all actual whirls or atoms are in some degree asymmetrical with respect to their chief main axial diameter and to the two diameters in their filiar plane; i. e., all atoms are spheroids with the three diameters unequal in some degree. So it is clear that if atoms are oriented in fairly regular simularity, as in a crystal, there will be a tendency for a ray of light to be cumulatively rotated so long as it keeps traveling through more atoms. Also a considerable relative difference in lengths of atomic axes would make the ray tend to have *two perceptible* dispersions, corresponding to those two comparatively large cumulative causes. Such phenomena and many more similar in principle have been observed. —— If a ray of light be sent through a transparent non-crystalline collection of whirls that are in a magnetic field, in the magnetic direction (XIV) it would obviously be rotated some with cumulative effect, and also in decreasing proportion it would be rotated some if passed in any other direction (up to the theoretical limiting direction exactly perpendicular to the magnetic direction). Then, the ray, if sent back over approximately the same path, is observed to have its rotation doubled (which phenomenon is called the Faraday effect). —— Clearly, in the case of the ray passing through a crystal each ray is subjected to the total effect of the atomic fields (i. e., those fields are small, and each ray is as a sum subjected to the effect of *all* portions of the whole field), and the rotation is the algebraic sum of the general, systematized asymmetry of those fields; so, as is experimentally observed, any rotation of a ray is approximately cancelled if the ray is sent back along the same path through the crystal. But in the magnetic field only *one* direction of asymmetry is introduced (the direction of the magnetic force); hence, if the ray be sent in one direction it is rotated in one way, and if sent in the opposite direction it is obviously rotated in the opposite way, which algebraically

doubles the numerical value of its rotation and gives the Faraday effect. It therefore directly follows that a magnetic field is a large field around an electrical apparatus or collection of atoms, that is equivalent to the field of an atom. —— As the Faraday effect is obviously merely a special case, we also see that there can be indefinite variations of that effect, depending on how we complicate electrical fields; many such variations in the phenomenon have been observed. Perhaps the most discussed variation is the Zeeman effect (for details of it and of other phenomena mentioned in this paragraph, see Wood's "Optics," XVI, XVII):- briefly, it is observed that the speed or color of a given ray is changed by subjecting its source to a magnetic field; e. g., the heavy yellow line or band of sodium will be broadened in the spectrum, and then be split in various ways (i. e., new bands perceptibly appear where before was *perceptibly* a continuous band). It is obvious, from all our foregoing descriptions, how that would occur. I might mention explicitly another point definitely involved in the Zeeman effect:- the filament (or any structural part, such as a spherical condensation—remembering it moves in an orbit) obviously has *two dynamically opposite* halves. Now, in all cases any line produced in a spectrum by such a structural part must necessarily consist of at least two parts more or less perceptibly continuous; obviously, if the structure were perfectly symmetrical there would be only two parts, but asymmetries cause the number of parts to be in infinite regress. Therefore, it is obvious that if the source of light is subjected to magnetic force it has superimposed upon it a heavy outer field which makes all the whirls more energetic, and will orient all their chief structures more or less systematically, and hence will spread out their bands in unending modification, with all variety of polarizations of the newly perceptible lines.

f. Biot's law is to the effect that rotary dispersion is nearly proportional to the inverse square of the wave length (Wood's "Optics," 379). That is obviously equivalent to saying that given the effect of certain transverse components (of 2 components or dimensions of space), the longitudinal component varies approximately as the inverse square. And that law is clearly the rational completion of Balmer's formula and Moseley's law (§128de). All three laws together obviously agree with our general equation in §126fg, and show by direct experiment that the argument of this book is sound.

§131. a. I have mostly been describing the phenomena of light from the point of view of following the ray out from its source and observing how it changed with respect to its longitudinal component (§§127-9) and with respect to its transverse components (§130)—it being noted that the components are not actually separable. Now, obviously, the whole of light may be described from the opposite point of view:- considering rays as coming in from all directions upon a cell which is *to become* a source, and observing how those rays combine—what sort of source they make, or how they modify the cell. Obviously, always the rays must first be built into the structure of the cell as part of the cell, and in the end sent away modified (that being a truism of what a ray is); and conventionally that phenomenon is divided usually into two parts:- (1) some of the ray is sent away (*reflected*) *almost* at once; and (2) the remainder of the ray is more extensively built into the structure of the cell (*absorbed*) and later on sent away seemingly as "new" light. (The orthodox descriptions talk of total absorptions, reflections, etc.; but obviously, all of that zero and infinity talk about "total" means merely "perceptible," relates to nothing which actually happens if it be explicitly interpreted, and so is not scientific and may be ignored). —— Briefly, all those numerous possible phenomena may be described from this other point of view by reversing the descriptions already given, and picking out conventional names for the result, so far as there are such names. The point to be emphatically kept in mind in doing that is that the cell is itself bound by a closed line in any cross-section, so that always "anomalous" and "rotary" phenomena will necessarily occur.

b. Those various details of reflection, absorption, diffraction, scattering, color (all color is in some degree "body" color and not in any absolute sense "surface" color, as obviously no light can be reflected by or at a *geometrical* surface), caloreseence, fluorescence, etc., will have to be mostly omitted here. I shall imply a few of those phenomena in the next section (the last on light), by showing the principles of so-called cold light.

§132. a. It was implicitly shown that a self-luminous source of ordinary visible light is a collection of atoms which has some of its principal difference surfaces at V_1 as a result of its own internal energy. And that at once implies that those atoms are considerably out of balance, or generally high in potential with respect to most other bodies in our environment; for obviously, most bodies in our immediate environment are not quite self-luminous [132a]—the general potential of our earth-surface is slower than that of the luminous sun-surface which is our chief source of visible light. Visible rays come from a source and fall upon the difference surfaces of our usual bodies. First, a little of the light energy is absorbed by those slow atoms, and usually speeds up the whole atomic structure a little, and that gradually and smoothly and without much unbalancing brings some of the surfaces to V_{IRV}. (If all the perceptible surfaces are too far below V_{IR} to be brought up in speed that way, obviously the body or collection of atoms will be transparent.) It clearly would take a little time thus to speed up the surfaces; there is a *time lag* in all finite phenomena (§§101, 136, 149, etc.); in light that lag is usually too short to be perceptible. [Explicit recognition and use of that lag in light would give for light in the $M(varying\ with)L^2T^{-2}$ member, two coefficients corresponding to the electrical K and U, etc.; see the discussion of Ohm's law, §136. So it is obvious that the orthodox mathematical theory of light will have to be substantially wholly rewritten, if a reasonably consistent mathematical theory of light is desired. This parenthesis suggests several volumes of mathematics, omitted here.] —— Second, after that absorption during a little time lag, the cells usually begin to give out rays (to "reflect" the light that falls on them), at a rate and in a form of structure in nearly exact balance with the rays still arriving (so that the angle of incidence is approximately equal to that of reflection, except when perceptibly modified by the curved difference surfaces, when various well known modifications of such reflection

[132a] That is implicitly shown by Le Bon, in "The Evolution of Matter" (Legge's translation, 1911), by giving numerous experiments on what he calls "dark light"; i. e., our usual atoms are just below the limit of visibility with our eyes. Also, invisible atoms continually give out various other invisible rays: quite possibly some of those rays have a velocity V_{IRV}, but with intensities below perceptibility; but there are probably rays of different orders (X-rays, results of secondary whirl formation, etc.), which naturally are invisible, although when given time enough they will register on a photographic plate. Those facts and guesses imply quantitative problems, concerning which Le Bon's book bristles with suggestions. He anticipates many important general conclusions of science:- e. g., he gives experimental proof of no constant atomic weights (in several places), and definitely asserts that principle (ibid., 160). *But* he denies the principle with reference to matter (121); or he vaguely asserts the need of a dualistic Creator, and in definite effect asserts dualism of ether and matter (74). Le Bon is a sort of bad boy of science; he keeps bringing out the family skeletons and advising that they be thrown away—giving first class experiments to prove his point. But he never actually throws them away.

occur). Those given-out rays are roughly what is conventionally known, in other context than this talk of "reflection," as *cold light*—the name implying that a high percent of the energy received is given out as visible rays; of course, all energy received may be considered to be given out as some sort of rays (calling secondary whirls of any order *rays*, as is possible: such whirls may be said to be light that has a very large time lag). Sometimes, however, that light is not so nearly exactly balanced as in the phenomenon called reflection, but makes the difference surface luminous by adding energy that is then given off as rays of perhaps different colors and not necessarily in definite relative directions: then the "cold light" is probably a little less cold (a little less "efficient"), and the phenomenon is called *fluorescence*. When there is a perceptible time lag (as there usually is with 'fluorescing' solids) the phenomenon is called *phosphorescence*; the lag may be for hours. Obviously, in principle cell reflection and absorption must be accompanied by some phosphorescence, and there can be no such thing as an exact fluorescence with a zero time lag.

b. Obviously, the most efficient cold light is thus reflected light (or phosphorescence, in somewhat less degree), and it is such because there does not have to be any general raising of the potential of the reflecting atom. Only the chief difference surfaces are smoothly raised to a higher potential, without so many unbalances being produced that (truistically) considerable secondary whirl formation perceptibly occurs (as heat or unsystematic formation, usually; as chemical reactions when continued long enough to be more systematic; as radioactivity, if continued longer still—for perhaps centuries—so as to systematically perceptibly change even elements; or as electricity, when collections of atoms are perceptibly systematized). That sort of reflected light or cold light with no practically perceptible time lag is used by us all the time when the sun is available. When we speak of cold light however, we usually mean that we want a "cold" source of light when the sun or other "natural" source is not available. Obviously, the best such source would be to construct atoms which have an absorbing lag of about twelve hours, and then a phosphorescing lag of about the same time. It can be done of course; it is a quantitative problem and the principles are simple; such a collection of atoms would be a 'light storage battery.' It is perhaps a difficult quantitative problem, however, and possibly impractical. So we consider other less efficient cold lights.

c. As the reverse of a fact seen in the last paragraph, all chemical reactions are in some degree "phosphorescent"—often perceptibly so. Actually, all our sources of artificial light in which we use what we call combustion (as in oil lamps) apply that fact—are reactions in which the phosphorescence is intense. Because that combustion reaction is so intense, usually there is much secondary formation, using much energy in invisible rays. So if we make the chemical reactions slower, as in a fire-fly or in some decaying woods, there would result more efficient light. Also, it is obvious that if we have more or less a ball of atoms, of great size relative to the size of one atom, there will be many visible rays formed which can not get out, and will build up larger structures than visible waves. So, other things being equal, it would give more light to have thin layers of atoms as a source. Also, if the atoms may readily slip on each other (have weak fields, as in a gas or liquid), they will use considerable energy by such motions—with resulting secondary whirl formation. So again, other things being equal, it is preferable to have dense, strong atoms that are crystalized.

d. I omit the easily seen principles of how to get efficient light from radioactivity and heat, except to show how the artificial lights we ordinarily use apply some of the heat principles. Burning gases are fluids and not very efficient in producing visible light; so they are used to heat mantles that are comparatively thin layers of probably crystallized atoms, and hence by the last paragraph give a larger proportion of visible light. And the general principle of phosphorescence (that the atoms should be raised in potential smoothly; par. b) ought to be used. And that principle perhaps has been used in those mantles (by trial and error—certain rare earths being best so far as is known). Also, the same principles are applied when tungsten is used for lamp filaments. Tungsten except by one chance in infinity is not the *best* material.

e. Apparently the simplest form of the quantitative problem of cold light is the electrical. We can in a short interval of time give a strong electrical jolt to a thin crystalline material and remove that boost in potential before there is time for much secondary formation. Such a voltage jolting is obviously analogous to light vibrations themselves—the jolts *are* vibrations of large, enveloping magnetic fields. And fairly good cold lights have been made on the electrical principles just stated, by Dussaud ("Harper's Magazine," July, 1903); but Dussaud's seem to me practically to cost more to construct and maintain than is economical.

f. It appears again, in this summarized practical view of light, that the chief importance of light in our future use of the environment lies in applying it to get the definite structures of atoms. Obviously, if we know the structure of particular kinds of atoms and molecules we can find what structures give particular properties, and what properties are quantitatively consistent (i. e., are in harmonious periodicity); and subject to such natural quantitative relationships, we obviously can design and construct atoms and molecules to meet any given need. That applies, by the total of valid logic, to molecules of our nervous systems also: given enough knowledge, we obviously could make or construct first class brains by giving proper food and environment. This book proves in principle that such civilization is possible. I have extensive ignorance of the quantitative measures.

CHAPTER XIV. *Electricity.*

§133. a. In astronomy we discussed formally or logically separate whirls one by one; and in light we reversed that to a certain extent and had collections of whirls which were considered continuous. In each case we were simply following our usual way of observing identical phenomena, which have been named differently because we do take those two points of view with them. Now, electricity is the same phenomenon (ultimately, that of reaction by cohesion, force, love, etc.); but we take another point of view and so the description is in new or different L and T terms.

b. And this new, but obviously entirely arbitrary point of view of *That*'s and *This*'s consists of taking perceptible or larger whirls (even molar bodies) as unit collections (as electrical "circuits," etc.); viewing them sometimes one by one and sometimes as if continuous, and with this additional *changeableness of point of view:-* (1) sometimes we consider ourselves in a static part of the universe looking at one of those collections that is moving or dynamic (giving us magnetic electricity or *magnetism*); (2) and sometimes we consider ourselves in that moving part looking at a collection of whirls which directly displays no magnetism because we tacitly or logically move with it (giving *static electricity*).

c. That new point of view, in which we see matter or moving ether in a certain aspect, is called electricity (or more precisely, the point of view is called the science of electricity:

electricity itself *is* matter): and it obviously is logically inclusive of astronomy and light. We merely have new conventional names (many of which are used in everyday life) for collections of whirls which I have heretofore usually described without mentioning their "electrical" names. The novelty of the new point of view is chiefly that we take two points of view of the phenomena without conventionally being very explicit about what we are doing—and hence are orthodoxly "surprised" when there bobs up at the end a $K^{-\frac{1}{2}}U^{-\frac{1}{2}}$ that is equal to V_1 (§77).

d. Let us, in order fully to understand that conventionally omitted condition in electricity (it does pop up finally, as just stated), consider an astronomical analogy. Suppose we fancy ourselves established at some convenient place in the galaxy field, so that we can view the galaxy filament and the solar system. If we are in that field, then we move with the field let us say; but by ordinary conventions we omit saying anything about *our* motion, taking the field as static. —— There is nothing abstruse or difficult about that:- if we wish to state how we go from Boston to Chicago, we say that we go west, thus verbally or by language agreement taking a static earth—while with reference to (say) the sun we would travel in a complicated path, which was at one time or another pointing in every direction.

e. In the next two sections we see those two "sorts" of electricity more in detail. We need to note further here that theoretically we can obtain from each of the two points of view all the phenomena heretofore described. And we obviously can not obtain any new kind of phenomena as electrical ones—for all of electricity is merely reactions of two or more parts of a machine (that being a truism of par. c), or additional ways of naming the dots in *That*...×*This*.... So former descriptions, with the names or L and T changed, will apply to electricity, necessarily an essential repetition. Therefore, except for brief indication as to how to start any explicit electrical description, I shall omit the possible volumes of electrical phenomena. The fact is that electricity is the easiest phenomenon to decribe mechanically; the reader who has grasped the general idea of mechanics can readily do it for himself if interested.

§134. a. If any whirl be moved relatively to another whirl, truistically the fields will react (by direct friction if the two are adjacent; by indirect reaction of whatever chain of whirls intervenes, if the two are not adjacent); and the reaction or result is conventionally called electricity (actually it is conventional electricity if the resulting series of phenomena is *perceptible*; but we take it that any phenomenon is perceptible if we observe closely enough). —— We might of course say that an electrical phenomenon could and does occur as the reaction or relationship of field and filament of *one* whirl which is either the whole or a standard universe; but so far as I can make out, conventionally electricity is the reaction of at least two explicit whirls or collections of whirls. —— That conventional definition makes electricity a relationship, or a force, or God the Holy Ghost—which shows (cf. Part One) why the conventional "electricity" is so intangible or ghost-like. But, as we saw in Part One, we can not have a force *alone*; the force is a verbal device which *implies* whatever concrete parts there are which are thus related—and those implied parts are "matter." And orthodox science, which holds that an electron is a unit of electricity, obviously holds that a small whirl (a part of an atom) is electricity—which is the same as saying that electricity is matter. And it is quite orthodox to say that electricity is energy. So conventionally, *electricity* is used as all three of the Trinity. So I shall use it as any of the three (§124).

b. As all whirls are, by our verbal agreements, moving relatively to each other, it follows that electricity is a universal phenomenon (see par. c for experimental proof); electricity, in that One extensiveness, is clearly a new name for asymmetry, incommensurability, or rhythm. It will be obvious after a little thought that when two bodies have, *in our environment*, been in fairly good balance with each other *for some time*, their fields are mutually balanced pretty well and have no *perceptible* rhythm, so that we say that the two have *zero* potential of electricity—are not electrified. Then (1) an unbalance occurring on one side of such equilibrium is called negative electricity (negative *potential* or *direction* is what is explicitly meant); and (2) the other, opposite direction of unbalance is called positive electricity. As a fact, we do not even know, with reference to any body of considerable size (say the sun), just what potential our arbitrary "zero" electricity is; i. e., it may by such a standard change considerably from year to year (truistically, it does change some).

c. If any two collections of atoms be more or less energetically rubbed together (i. e., 'moved relatively to each other'), and the two collections be made of atoms the axes of whose fields are not readily or quickly changed in direction (i. e., if the collections are not "good conductors," or are "insulators"), then there will obviously result a considerable surface unbalance of equilibrium if the rubbings always take place in the same direction (i. e., do not neutralize each other); or, what amounts to the same thing, if the two collections are made of somewhat different sorts of atoms such as a piece of glass and a fur skin (so that the two sorts of atoms are not oriented the same on the molar surfaces, and hence the rubbings, whatever their mutual relative directions, *accumulate* an unbalance). Such a considerable amount of unbalance is perceptible, and is static electricity. Obviously, such a condition of unbalance would result from *any* relative motion of two atoms, however small; but only in special conditions such as described does the unbalance accumulate locally into directly perceptible "static electricity." Thousands of experiments prove that general statement.

d. Obviously, in the creation of that static electricity the filaments of the atoms are either speeded up or slowed down: are changed in energy. And that changed condition of the filaments tends to persist (except in so far as the fields are of such nature that they distribute the energy unbalance —"conduct" it,—as is always the case in some degree: i. e., there are no perfect conductors or non-conductors). So it is evident that in so far as that "charge" of electricity is actually static (in so far as the fields do not readily orient themselves, be conductors, and move the electricity as a "current" elsewhere), then the motion (or lack or decrease of motion) has been taken up by the filaments, and the filaments are what we might call the dynamic part of that static electricity. The 'dynamic' electricity, which is thus 'inside' the "static charge," then consists of a "current" that *is* the filament of each atom (or, more explicitly, is a *part* of the energy of that filament if we imply the usual arbitrary zero electrical potential). That "current" is the filiar component (§125a), and is probably the orthodox "electric force"; the other transverse component (the circumferential component) is the orthodox "magnetic" direction; and the radial component (the direction in which light travels) is the direction of electric pressure (or attraction—to name it from the opposite point of view), and is perhaps the orthodox direction which Maxwell calls "electrical displacement" (see also §135c). —— I have not carefully checked orthodox electrical directions, in comparison with those I have just named and the point of view in §135c. The difficulty is that in actual phenomena—as contrasted with the conventional mathematical theory—one direction rather promptly closes

on itself (§135c), as do the others with less celerity, so that like our filiar or current direction just mentioned it has really a continually changing direction, instead of a mathematically abstract fixed one. So it is difficult to judge what directions orthodox mathematics, such as Maxwell's, are referring to. I personally cut the Gordian knot by not bothering to observe when dealing with such *theory*, but we must know directions in practical application. —— Clearly that current is in all directions, and so that component *internally* approximately balances itself; the magnetic component similarly balances itself; and the static charge therefore exhibits no *perceptible* magnetism (because dynamic electricity does exhibit magnetism it is called magnetic). So the only somewhat unbalanced and hence perceptible component is the pressure or attraction, which is the *accumulated* sum in some given direction resulting from the rubbing. That component obviously corresponds to the direction of propagation of light and truistically is directly analogous to light pressure. So from this point of view electricity can obviously be put in terms identical with light, with unessential L and T differences. And that single perceptible component would evidently be *very weak* compared with the other components, which become perceptible in dynamic electricity.

e. To see definitely the ways in which that unbalanced component of force makes the charged body move, we must add other facts about the charge. Clearly, the charged atoms must be just a thin surface layer of the atoms of the charged body. That is a truism of the foregoing definitions, and is directly proved by Faraday's "icepail experiment" (Watson, "Physics," 641-2). It can be seen explicitly by the following considerations:- A charge can be generated on a body which is a conductor, provided the body is insulated. If in the generation there is exerted enough energy to do more than charge the surface atoms (which on their sides towards the air, are not well 'supported' or balanced by the mobile air atoms), then the resulting phenomena are called by other names:- obviously, there can be perceptible heat, light, eddy currents, etc. And evidently, for a body which is not a conductor, the resistance to any perceptible charging of inner atoms is greater. Truistically of course *all* the atoms in any charged body are to some extent modified, or are "charged" imperceptibly. The simple point is that the surface atoms are supported by the surrounding non-conductors (air, etc.) in a degree different from their inner support by field friction with other atoms of their sort, and the rubbed unbalance *perceptibly accumulates* as a "static charge."

f. The charged atoms truistically are in unbalance with surrounding ones. We may take it that the spirals in their outer field surfaces are in effect screw threads, so that the atoms tend to screw themselves along in some direction (because unbalanced, and as a means of getting balanced—just as the solar system is balanced by its revolution about the galaxy main axis). Or, that same tendency to move can be expressed by Bernoulli's principle, or by the principle of any machine, as seen in analogous cases. Clearly, if there is an unbalance 'sideways' (i. e., in any direction in the geometrical surface of the charged body) the charged atoms move in that direction, until there is fair sideways balance: that implies all the remaining details of the icepail experiment, of the accumulation of charges on points and more rapid dissipation from them, the variation in the appearance of positive and negative "brushes" of light during such dissipation, etc. Thus, rather rapidly all the charged atoms become oriented so that their tendency is to move in the (effectual) normal or radial direction to the surface zone they are in—they tend to screw themselves *into* or *away from* the body they are on (one direction characterizing a "positive" charge and the other a "negative"). —— If the charge is on a fairly good conductor, which ends in a point, those reactions cause the charge to accumulate thickly there, and a perceptible brush discharge may take place, which probably is a translatory motion of some of the atoms, and certainly of atoms of the air (for an "electric wind" can be felt). And that phenomenon may accumulate until a spark discharge occurs that is still more probably a translation of some charged atoms (for the sparks will make holes in paper, etc.). The problem of just what it is that moves is a quantitative one that can not be definitely decided except by actual measuring. I remember reading somewhere that those sparks have been experimentally formed into "balls," that move rather slowly; in such cases it is likely that the discharge can be experimentally shown to be a whirl. Obviously, it is theoretically possible experimentally to make the charged body's 'surface' give off a collection of atoms, which will form into such a "ball," or secondary whirl—of the *molar body*. That is an 'electron' of huge size—of a molar body.

g. Ordinarily, the charge is more or less rapidly distributed over the whole surface of the charged body (unless that body is a poor conductor), and truistically, then the electric pressure is the same all over a sphere, and analogously on other bodies, balancing itself without motion of the body.

h. But if two bodies, with *centers* A and B, charged with the same "kind" of electricity, be brought rather near together, obviously the atoms will screw themselves through the air in the same direction with respect to their respective centers (i. e., the atoms of say the first body screw themselves towards its center A, and those of the other towards B). Those directions are opposite to each other; so charges of the same sign or kind "repel" each other, and of opposite signs "attract." As charges of opposite sign are *always* created by any mutual motion of separation of two bodies, then obviously the "attraction" of opposite signs is nothing more than a statement, emphasing 'affinity,' that is the reverse in form to "inertia" (§88)—absolutely proving these mechanics as it reduces the expression of electricity to truisms (§35).

i. In the last paragraph the actual perceptible motion of the charged bodies themselves is obviously always preceded by the motion of the atoms on their surfaces in the appropriate directions, causing unequal piling up of the charges on those surfaces. That is merely the reverse way of stating the previous distribution of the charge, in par. g. That indicates the principles of "electrical capacity," etc.

j. It is obvious that that screwing action actually has components in three dimensions. Or, expressing the tendency of the two bodies to move apart or together by Bernoulli's theorem, their 'flow' relative to each other as a truism gives components of 'pressure' in the two transverse dimensions. Obviously, in no finite, actual, positive science can we absolutely separate those three components, or reduce their number. So we truistically get these important general conclusions:- The "zero" of potential is arbitrary—is merely the *average* 'electrification' of our present environment. So we may take an *almost* absolute zero of potential as being one which is *very* near to the body's not existing finitely. And as no two finite bodies can be perfectly balanced, it follows that every two bodies have different potentials; hence, with respect to a fully absolute zero potential every body is of a different potential from every other body, and, *as a truism of its existence*, attracts every other body with a force having *three* components. And it is obvious that *the component on the straight line between the centers of the two bodies* is *orthodox* gravity, and the other two components are orthodoxly unnamed, except *implicitly* as the "square of the distance" in Newton's law. That *separate* component can not exist alone

with finite bodies; always it is inseparably bound up with two other components—which in electricity I have named the current or electric component, and the magnetic component; or in light, the transverse components; or are combined in molar mechanics and named chemical affinity (thus when Einstein talks of light being bent, he introduces at least one of those two; when I talk of light corkscrewing, I introduce both explicitly, and talk of 'affinity'; §127). (Thus molar mechanics can be made absolutely identical with electricity, etc., by considering those transverse components as being *verbally* separate.) So it is obviously truistic that if any two bodies get into an equilibrium so steady as to have the two transverse or affinity components very smoothly balanced by the bodies' mutual revolutions, then the longitudinal attraction and repulsion is so smoothly balanced that we say there is no "electrical" attraction, and the comparatively minor attraction or reaction remaining 'externally' perceptible is named *gravity*; and as there is practically no change in it (none was perceptible to Newton), then gravity is said just to *exist* (*implying*, when we *have* knowledge that there are two other components, that gravity travels at infinite speed—which truistically drops *T* out of molar "science"). —— This paragraph expresses the ultimate truisms of the nature of gravity, in all three of its Trinity forms. And this section therefore expresses the mechanics of gravity in complete generality—in explicitly implied terms of any variety of machine and in explicitly implied terms of any sort of phenomenon. No further mechanics of gravity can exist. But obviously, many volumes of the explicit mechanics which are only outlined here could be written if needed.

k. The verbal trick in getting a consistent description or mechanics of gravity obviously is to use *finite* bodies—3 dimensions,—and thus not drop *time*. Newton's law implies, and asserts in so far as it is explicit, two masses at or as geometrical points; and obviously a consistent mechanics of gravity is forever impossible *for such points*. After we have the simple trick of three dimensions, all that is required is a little intelligence in recognizing the various conventional names already given to the reactions of the other two components, and to refuse to ever take them as really splittable—dualistic. In this section I have been explicit about those other two components. But Reynolds's and Erwin's mechanics of gravity use 3-dimension space, including *T*. Descartes, with his 3-dimensioned vortices perhaps may be said to have correctly implied the mechanics of gravity. Bjerknes probably has a correct gravity (§94a). Crehore with some indefiniteness gives the correct mechanics of gravity in terms of the mathematical theory of electrons ("Sc. Am. Supp.," April 13, 1912). Gautier briefly and generally gives a correct gravity (Le Bon, "Evo. of Matter," 98, quoting from "Revue Scien.," Jan. 13, 1904). That makes seven men I know of who have apparently independently stated the mechanics of gravity with fundamental consistency. Probably others have escaped my notice.

§135. a. If the rubbing of the two collections of atoms be continued, obviously the static charge will accumulate, and there will be a greater and greater tendency for the charged atoms either (1) to move bodily in the appropriate direction, or (2) to give off secondaries in that direction (to give off electrons, which will travel in the "negative" direction and by the third law of motion 'kick' the remaining part of the atom from which each comes, a little distance in the "positive" direction), or (3) to change the shape, speed, spirals, or "pressure" of their fields in such a way as to restore equilibrium. Those same tendencies obviously existed with the charge; as soon as they somewhat *perceptibly* act, then there is an "electric current" and we have *explicitly* recognized the existence of those fields (as expressly distinct from their filaments or condensations) which previously we neglected; and we have *dynamic electricity*. Clearly there is no sharp distinction between static and dynamic electricity—merely the quantitative one of when it is that we care to say that the field reaction ("magnetism") is *perceptible*. And that is crucially proved by the Rowland experiment, which shows that a charge moving fast enough is *perceptibly* a dynamic current (we saw in the last section that all charges move *some*).

b. In the last paragraph we saw that a "current" may be motion of nominally three sorts. Those three are ultimately identical:- i. e., a change of shape or spiral of the field will move the atom somewhat (and will keep on moving it as an "ion," if it is fairly free to move); and that change of the field may accumulate an unbalance which splits a molecule into parts called *ions*, or splits small secondaries off of atoms as electrons, or with more difficulty splits an atom into different "elements" (as has been done experimentally in vacuum tubes). Truistically, some of that actual motion and actual splitting will happen in any current: but probably *the chief part of the current consists of the changed pressure of the fields* which exists throughout the circuit. And those various aspects of the same final principle of temporary unbalancing of whirls obviously give unlimited scope for various phenomena of currents—mention of most of which I omit. The chief point to be noted is that consistently described currents do not need to have a flow of any fixed or proportionate number of "electrons" per unit of current (although taking *electron* in the complete One sense of *any* size secondary, truistically the current is *all* electrons). D'Albe ("The Electron Theory") gives as an outstanding defect of the orthodox electron theory that such a fixed flow is required, but does not experimentally occur (more modern versions of the theory attempt to avoid the difficulty by tending to revert to the One mysticism just mentioned, where an electron may be anything). Electron flow—of scientific, finite electrons—occurs only if the current is somewhat unsteady at the place where the flow is perceptible. Truistically there can be no perfectly steady current; therefore, the *size* of the jerks in the flow (or the jerks or knocks in the vibration or spirality of the fields) determine whether (1) electrons of a given size, or (2) ions, or (3) new elements, or (4) new chemical compounds, etc., 'flow' as the current. In short, theoretically the current may be used to give, or is, a 3-dimensioned spectrum. Such spectrums are actually exhibited in vacuum tubes (as striations, bands, canal rays, etc.). This description is obviously applicable to the numerous novel experiments so ably made by Thomson. And the good physicist can readily see from these general mechanics just how the various quantum theories give quantitatively consistent results. They are harmonic periodicity, applied to electrical phenomena.

c. When the atoms thus form a dynamic current, that *collection* of atoms which forms the closed circuit of the current is effectually (i. e., dynamically) a filament of a larger whirl or 'atom' (and the filiar axis is the *electric* or *filiar direction* or current direction), of which the field is the magnetism. And the *magnetic direction* is the direction of the well known "lines of force" that go around that filament, as the field flows around the filament in Fig. 98n. And the *direction of (static) electrical pressure* or *displacement* (cf. §134d) is the direction of the vector sum of the normals to those magnetic directions—i. e., it is the direction of the main axis of the large whirl of which the current structure is the filament. Thus, in dynamic electricity, we move ourselves *into* the atom, so to speak—into this big whirl. So the first two components or directions become *perceptible* (they are strong compared with "static" quantities), and Maxwell's displacement

or the static pressure component, which in static electricity is the only perceptible component from our point of view *outside* the circuit-whirl, becomes imperceptible in most cases, for precisely the same reasons that the analogous component of motion of the solar system (its motion more or less in the direction of its main axis NS′, Fig. 107e) is practically imperceptible to us. But obviously, the whole current circuit, with its magnetic field, constitutes *one* "statically" charged whirl (§134d). And in this dynamic electricity, *both* the electric direction and the magnetic direction are *perceptibly* closed on themselves. And as truistically some or all of the universe other than that large whirl is effectually a structure that balances with that large whirl, forming a closed "current" with it, *the displacement direction itself becomes a closed line.*[135e] So it is absolutely impossible to establish *any* directions in the universe, except locally and as finite ones that are portions of an ultimately closed line (§99; that is another aspect of 'curved color,' §128g). That is the rigorously general way of proving that no principle—*nothing essential*—dedends upon direction: that any question of direction is quantitative, local, practical, a matter of arbitrary agreement (and *relative*, in ordinary language—instead of *space* being so, or curved as in Einstein's theory). —— We also see definitely in this paragraph how a whirl can 'reverse' by *our* taking a different point of view. We change the *naming* of directions, and in doing so necessarily imply changes in naming of speed relationships which we ordinarily assert vaguely by the names *static* and *dynamic*. And obviously, the only possible way to understand that reversal is to take both points of view simultaneously (or in general, use inductive and deductive thinking simultaneously), and compare them; and the only way to do that is to take a universal view—solve the One and the Many. It is not an intrinsically difficult problem, being the old childhood problem:- if a monkey sits on a pole and keeps turning to face you, and you walk around the pole, do you go around the monkey or not? But this problem of direction, or change in point of view, or problem of what is the center of reference (in our "reality" there is no fixed center or the infinite universe is the center; §100c), or what is the difference between static and dynamic, or what does $K^{-\frac{1}{2}}U^{-\frac{1}{2}}=V_1$ mean, is a puzzling one (because we have been trained to "think"—really, to avoid thought —dualistically). It is identically the same problem as that of Good and Evil (XVIII)—and we are so used to solving that, that even children do it correctly several times daily (with etymological felicity calling it *con-science*). But if you ever start meditating on the problem of Good and Evil, or become so rash as to listen seriously to some dialectrician or other sort of demagog bandy words about it, then for the remainder of you life your will be confused by it, and will be troubled by it, and unable *satisfactorily* to solve such continually recurring problems of whether it is Good or right to take one slice of bread or two, *unless* you go into it vigorously and thoroughly and get to the bottom of it in utmost generality as above (or in any terms other than physical, if you do not care for physics; see XVIII), or *unless* you permit your brain to die a little so that you can no longer perceive the irritation of such questions. The latter is the usual human solution, and gives peace at the expense of living less (the peace of the grave). However, because of the infinite regress, always we will use that peace-of-the-grave solution somewhat—automatically, naturally, and hence rightfully and justifiably using it more and more as we get older and personally wear out, finally wisely and contentedly wanting such peace completely. Henry Adam's "Education" did such dying publicly, and because he held it up as highly praiseworthy he comforted us, and had a vogue. But Adam's reasons—that the grapes were sour—are obvious nonsense; only because he was the champion snob this country has produced was he able to commit the human indecency of publicly parading his dying—and we are all interested also in any sort of championship performance. Adams's snobbery took the Higher Expression of indifference; I have tried that myself in my time, and it works fine—the trouble with it being that if a man hasn't already got the various Puritanical vices, that breeds them in him. —— The Deep Thinking which Adams proudly implied he did is about 79 per cent piffle.

d. Those magnetic "lines" that surround the current may be readily explored experimentally and are described at length in most physics textbooks. It is well known that they have a spiral twist—that giving direct evidence of the nature of whirl fields (experiments of Hittorf, Moulton, Spottiswoode, Stewart's "Higher Textbook of Electricity and Magnetism"; or see Tunzelmann's "Electrical Theory," 192). Obviously, if any body rotates in a fairly balanced way its part (or parts) that is moving in the equator moves faster than the other parts, and as that part is rubbing against something it is thus dynamically equivalent to *a* current and to a filament. So a magnetic field will be built up about it. That is why the sun and earth are magnets, and why the spherical fields are called magnetic fields; the present way of viewing the phenomenon is the reverse of that in §116c, and shows that astronomy and electricity are indentical in principle. As the equatorial band of atoms becomes a current, then such a current tends to be of the same shape as a fluid filament, and will therefore speed up the equatorial matter (as observed in the sun, etc.; and give equatorial currents of air, electricity, and water, as observed on earth). And that tendency of the equatorial bands to get ahead exhibits the universal principle of overrunning, asymmetry, or vibrations; i. e., any structure will tend to start a new one on its equator. That sums our descriptions into universal truisms from another point of view.

e. Therefore any whirl is a "permanent" magnet; it is not absolutely permanent, of course, and is always changing some; but its magnetism is due to, and as permanent as, its own structure. Obviously, chemical affinity is in principle completely analogous to magnetic attraction. Hence, all atoms have some degree of "induced" magnetism—i. e., there can be no such thing as a negative U (although otherwise reputable physicists sometimes speculate on such a source of "perpetual motion"). Such magnetism of all atoms truistically exhibits itself in some degree of orientation of the main axes of a collection of atoms in the same direction —a phenomenon usually imperceptible, or else given some other name. In induced magnetism a perceptible field is imposed upon atoms from their environment, and may be retained for some time (lag); such atoms as Fe may stay so energetically oriented that they are considered permanent, and will in turn throw their environment out of the conventional zero magnetic balance. —— That is quantitative, in agreement with orthodox theory, but more generally stated.

§136. a. I shall now make a brief statement of the unification of all phenomena in terms of both the naming member *That...*$\times$*This...*, and the measuring M(*varying with*)L^2T^{-2},

[135e] Obviously, as a truism of the principle of asymmetry, any two atoms (especially of different elements) or any two molecules, to some degree form a closed static circuit. So any phenomenon which perceptibly disturbs the static electrical balance creates a perceptible dynamic current. That gives the principles of currents that are experimentally generated by heat, light, percussion, etc. Ultimately any motion anywhere causes—is—a current, so that experimentally the mere making of contact of different elements may give a perceptible current. Also, the same general principle explains all kinds of primary and storage batteries, electroplating, etc.

by using Ohm's so-called law. Orthodox science substantially recognizes that Ohm's law is not consistently applicable to all measuring of currents, and so correctly holds it to be a rough empirical rule. Hence, I am merely extending orthodox science in this chapter. As a fact, Ohm's law is a One law, a valid religious statement which runs A to infinity (asserts in effect that chemical affinity is the *only* factor), and so flatly contradicts Newton's law, which runs W to infinity (asserts that weight is the only factor). If we add the two laws, revising classic logic in order to do it, we get the truth.

b. Ohm's law (when its *implications* are explicitly expressed) is as follows:- (1) A steady current in a conductor is directly proportional to the impressed (electrical) force (to E —electromotive force or E.M.F., which in IX was called P), and inversely proportional to the resistance R; or, $C=E/R$. (That C and R are not the same C and R used elsewhere in this book.) (2) The conductor is supposed to be perfectly homogeneous and of perfectly uniform cross-section; and its resistance is taken as directly exactly proportional to its length and exactly inversely proportional to its area of cross-section.

c. That law approximately agrees experimentally with a current in fairly good conductors that has had time to become as steady as possible. It is very inaccurate—quantitatively fails considerably—when the conductor is rather poor (say in gases, as an exaggerated example), and when the current is "building," or "dying out." It is obvious that there is neither any perfect conductor nor perfectly steady current, as would be required to make Ohm's law both logical and accurate; so it is a One law, and *never* a scientific law. We can see that as a truism:- If we call the length of the conductor L, its cross-section is L^2 (§68c); and substituting for R its value, as given by (2) in the last paragraph, we have $C=E/(L/L^2)=E\times L$. And in that equation C is electrical matter or energy, and E is a name for force E, and we have the orthodox equation $Energy=F\times L$, it being asserted that there are no dots, or that F and L are perfectly sharp and distinct—that there is exact science, that classical logic and dualism is true, etc. —— Or, E may be considered to be P in $Q\times P$, and hence stands for L^2; so that $C=E\times L$ is equivalent to $C=L^3$, meaning that C or matter or energy, as a purely One truism, occupies 3-dimension space. —— Or, in an even more directly obvious way, $C=E\times L$ asserts that matter C *is* force E which exists perfectly smoothly over a *straight* line—and no matter or structure can thus be infinite, but always closes on itself.

d. We thus see that essentially Ohm takes a filament and asserts that *only* a filament exists, and that it exerts a force throughout a line. Newton substantially says that only a field can exist around a point-mass which is a zero-filament, and the force then exists throughout the field, and hence inversely as the square of the distance. Both exaggerate one half the truth by reducing the other half to zero. —— Of course, neither man saw what he was doing that clearly; if he had he naturally wouldn't have done it.

e. In establishing a current a certain time truistically is required for the motions (§135a) to be set up; there is a lag. Hence, because of that lag, with reference to the steadiest final current U varies; i. e., the magnetic field is not steady (XI). Similarly, the static displacements are not steady (cf. also XII); or the lag also makes K variable (cf. §§75-7) Obviously, always an actual current is flowing over asymmetrical parts so that always there are some local vibrations or rhythms of current—a building up or down,—and hence, K and U can never be in any way *steadily* proportional to either the L, or to the cross-section L^2 (Ohm's law tacitly assumes that the are), even though that matter symbolized by that space L and L^2 be made of the same sort of good conducting atoms. If the atoms conducting the current vary much, or if the current flows in loosely self-supported atoms, those variations of K and U truistically must be greater. And the fact is that with such atoms the variations are great enough to give wide deviations from Ohm's law. It therefore follows that the rational scientific Ohm's law is $C=E...\times L...=MK^{-\frac{1}{2}}U^{-\frac{1}{2}}L^2T^{-2}$,—in agreement with IX.

f. As there is a time lag in every phenomenon (a truism of the phenomenon's existence, as seen before: or this is a brief truistic proof of it:- if the phenomenon did not require time to occur, it would be absolutely instantaneous, and hence absolutely imperceptible, and hence would not be a phenomenon), it follows that that general proof of the variability of K and U applies to the coefficients of all phenomena. We thus complete the circle of proof and check IX.

§137. a. That finishes all the general suggestions about the numerous electrical phenomena for which we can reasonably spare attention and space. In this section I mention three more or less important details, and close the chapter.

b. (1) Thomson's electron theory has electrons which produce phenomena by the travel of "kinks" in their tubes. It may readily be seen that the locus of those kinks is identical with a difference surface. Also, it may readily be seen that his "positive" electron, or the "nucleus" of any atom, is identical mechanically with the filament. Our whirl theory is identical mechanically with Thomson's electron theory. We have seen the mechanics of electrons in three dimensions —and that is merely an extension of the electron theory, which can not take those 3-dimensioned mechanics far.

c. (2) Experimenters are now tending to get equal measures for all electrons—tending to show "by figures" that an electron is a fixed, constant unit. Millikan ("The Electron") has done some elaborate and able experimenting tending to show that electrons are all the same size, and constant. Superficially those experiments seem to prove that my proposition that electrons and everything else vary, is wrong. Actually, those remarkably accurate and ingenious experiments prove something else, as I shall show—not only about electrons, but about measures of atomic weight, conservation of weight, about Perrin's counting of atoms by means of the Brownian movement, and in general about any sort of experimenting which becomes so remarkably careful and good that it rather loses sight of its primary object and gets another.

d. Landolt ("Ency. Brit.," ix, 257) weighed several pairs of substances before and after they had chemically reacted or combined. He at first found a *perceptible* difference of weight with some of his experiments—that agreeing with our principle that there would be more or less transfer of secondary whirls (of electrons) between the environment and the substances (e. g., the substances would truistically *lose* weight as heat *if* the reactions produced heat). But Landolt apparently thought that the *One* law of the conservation of weight (i. e., the total weight *of the universe* does not change) ought to apply to his little *parts* of the universe; at least he acted as if he thought there ought to be absolutely no change of weight with his parts, and began to make his experiments more elaborate. Instead of driving simply and directly *at* the point he wanted, as he did at first (and finding some changes), he began in effect to try to *average* all the conditions—*to make corrections for all perceptible asymmetries.* The effect of course, as a truism, was that he substantially included enough *of the environment* in the results of his experiments to make the changes in weight imperceptible. Truistically, if we "correct" *any* phenomenon with *enough* of environmental asymmetries we get a *perceptible balance* or a zero phenomenon—and there naturally was no unbalance perceptible in Landolt's wider conditions (it is the principle seen in §25c,

that the late Kaiser was right and beautiful *if* we take in enough of his environment). I. e., the total universe is absolutely in balance: and if we observe *enough* of it at one time we can not perceive any unbalance of that with the rest. So Landolt's measures are probably right in both cases; but in the case of "correcting," where he *perceived* no change of weight, he proved, not that no change of weight occurred in the chemical reaction, but that none happened perceptibly in the phenomenon of the reaction plus enough of the *L and T* environment to make a *perceptibly* standard One. In short, he became technically such a good and careful and exact experimenter that he lost sight of his real point. —— It is possible to be just as intemperate and frenzied in exactness in experimenting as it is to be intemperate in the use of alcohol or in a refusal to make any "material" experiments (to verify dogma). Materialism is the result of taking *experiments* too seriously; scholasticism or sentimentalism or the Wilson pseudo-idealism is the result of taking *principles* (or in practice, dogmatic authority) too seriously. Both sorts of intemperance lead to equal error and human pain. E. g., excessive experiments led to materialism and the Prussian militarism; excessive dogmatic, dictatorial, unverified dogma or principles led to the Inquisition, etc. Valid science is a temperate balance of experiment and of principle—is rigorously *simultaneously* inductive and deductive (as proved in §163j).

e. And the same thing happened in the antiquated efforts to get "exact" atomic weights. When atomic weights of a given element are found in several ways by means of different chemical reactions, often they perceptibly vary considerably (Ostwald, "Outlines of General Chemistry," trans. 3rd ed., 1912, 126-50). The effort substantially was to subject the given atoms to a severe and lengthy bombarding, and shaking, and smashing (by means of chemical reactions mostly). They thus got nicely worn out and smoothed off to a sort of aged average condition, and if the averaging were sufficiently enthusiastic, obviously any element would give an apparently exact atomic weight. But the conclusion to be derived from that is not that atomic weights are constant: the relevant conclusion is that we can by sufficiently widening conditions of given atoms get an average weight which is perceptibly steady. That correct conclusion as to exact—really, "average"—weights is a correct One conclusion applying to a *standard* universe that includes an elaborate, rather standardized, violent laboratory environment: it truistically does not apply to specific atoms in a natural condition. It would be more intelligible if it were made a *whole* One conclusion:- that in the whole universe all atoms are arbitrary anyway, so ultimately all atoms of all elements have the same exact weight, namely 0 or ∞, as we choose.

f. The Brownian movement consists of motions of very small solids, etc., in a fluid, like the dust in the air that is seen in a beam of sunlight. Evidently, if the particles are small enough their fields, by reacting with the fields of the atoms of the fluid will more or less support them against gravity; i. e., the "movement" exhibits some 'affinity' just as do the structures of our galaxy (XII). Perrin ("Brownian Movement and Molecular Reality," Soddy's trans.) substantially concludes that those particles (1) move in straight paths to collisions, (2) are exact and eternal in their motion, and hence (3) that such observed motion proves the existence of exact and absolute atoms, of exact weights, etc.—which measures he calculates. (Millikan gets different measures by experiments of a different sort.) Of course, as Perrin himself unconsciously admits, by tinkering with conditions long enough he does succeed in getting perceptibly steady averages: but he had no such steadiness in his first unsophisticated conditions. Truistically, the Brownian particles do not move in straight lines, are not perfectly elastic, and do not achieve any perfect or permanent distribution—they actually will either agglutinate, or else will rub themselves into small enough "pieces" to 'agglutinate' with atoms of the fluid (react 'chemically' with them; or become a solution, or ions), insofar as they do not agglutinate chiefly by gravity at some stage. Obviously, by catching them in their career at just average condition, "exact" values apparently result.

g. The first measured weights of electrons varied from about 1/1000 to 1/2000 the weight of a H atom. But the experimenters, in more or less conscious imitation of each other, are getting the conditions of measuring electrons standardized, and getting apparently a more exact value. Of course, those experiments have a value, as they indicate what *are* the criterions of average environment of electrons. And they really prove that the electron is a variable body that *is* amenable to changes in conditions (apparently much more so than atoms), so that it will behave itself and give a certain value for certain conditions. There would be a real miracle if it wouldn't. As soon as electrons and atoms get into a laboratory they are hustled into a Procrustean bed.

h. (3) The last minor point is that an alternating current is a rhythmic current which acts on the same principles as cold light (§132).

CHAPTER XV. *Heat, Chemistry, etc.; and Summary of Part Two by Practical Applications.*

§138. a. The remaining conventional general classes of phenomena are sound, heat, and chemistry. Above I have not fully and specifically considered phenomena under those names; but it was shown that certain principles held universally, and by a few suggestions in this section it will be shown that they apply to these other classes of phenomona.

b. Sound is identical with light except that sound is the vibrations of atoms (molecules) considered as continuous, instead of ether cells considered as continuous. I. e., sound is light of a different order. Orthodoxly sound is considered to be purely a longitudinal vibration. But in such a description the transverse forces are tacitly taken for granted, while attention is chiefly focused on the travel of the sound in the longitudinal direction. For obvious structural reasons the longitudinal component *is* more perceptible in sound. So there is only a quantitative difference between light and sound. Therefore, the general theory of music is obviously analogous to—is—the theory of harmonic periodicity, or is analogous to the principles of the order of lines in spectrums (§101fj). So, as astronomical bodies make larger spectra, or are directly in harmonic periodicity, "music of the spheres" is a scientific fact.

c. Heat is obviously, from the facts shown as to surface temperatures of astronomical bodies (XII), the same thing as electricity, except that it is less systematic. E. g., when electricity is formed locally in a large mass of conducting atoms it forms eddy currents—little local circuits. And those result in, or change into, heat. So heat is an eddy current a trifle more unsystematic than a recognized eddy current—in fact, it is not possible to distinguish a dividing line between a systematic or "electric" current and its so-called degeneration into heat (cf. the reverse, footnote 135c). So truistically all phenomena may be described as heat; but when some *part* of a phenomenon is systematic, that part is conventionally given another name. What proportion of the whole that part must be to get a name of its own is not agreed upon—nor the degree of system or perceptible balance required to constitute "systematic." —— The practical means of

drawing an arbitrary line between heat and other phenomena is to compare the reacting substance with the L and T reactions of a substance in a "thermometer." If we use the same substance in all thermometers (and select conditions so that the time lag causes imperceptible variations), such comparisons *imply* an approximately fixed arbitrary line between the heat part that perceptibly affects that thermometer substance and the more systematic part of the phenomenon that ordinarily does not (although a part of that systematic part is sometimes called latent heat). But even if everybody used the same thermometer, its substance constantly changes as time passes, so that in principle there would not be the same substance thus to fix approximately the definition of "heat." As a fact, thermometers made of different substances show variations as to where or when heat becomes heat. Thus thermometers give direct evidence of an infinite regress.

d. Those generalities about heat are obviously immediate truisms of the principle of asymmetry. Our natural structures, taken one by one, are mutually asymmetrical in some degree; so if taken in bunches (as atoms are taken, relative to "heat"), the same asymmetry is repeated (in step by step 'orders' forever), and at some point the asymmetry becomes perceptible. E. g., a larger observer, for whom our galaxy is an atom, would perceive nearly any change in the galaxy as heat; reactions rather systematic to us (such as the earth's revolution) would be to him minor asymmetries or "heat." Truistically, the harmonic periodicity of that arbitrary dividing line between heat and systematic phenomena is itself a kind of spectrum. —— That shows again that regardless of what terms we use to describe any reaction, identically the same terms will consistently describe the total universe. E. g., we could describe the universe in terms of smells or odors—finally writing a mathematical discussion of the periodicity or spectrum of smells:- For obviously, an odor is an evaporation from a body, and would exist in some degree for all bodies, regardless of whether it was perceptible to us. And that evaporation would in some degree change our atmosphere, and would truistically step by step change the universe. —— Incidentally, if anyone fancies that because we now have a consistent logic to use as a general tool in science, religion, and philosophy, no more "opportunities" exist there—fancies that all the "big work" has been done,—then the mildest truthful opinion I can express of him is that he is a fool. For obviously this book is merely a positive, firm first step in knowledge; nearly all actual knowledge and its application (no knowledge is really knowledge until it is applied, for only the application can fully prove it; §35) lies in the future, to be expressed in those volumes I mention omitting. Just now we see how much we must omit of heat. This book is an elementary first step, the essential substance of which probably in a century will be familiar to children of fourteen (they will not need to have many details of the concrete proof at that age—or the confusing discussion of classical logic which I have to give), and will be their basis of conscious living.

e. Those things about heat may be stated another way. We saw (§§134jk, 103, etc.) that gravity is what we may call the unsystematized residue of reaction that is left when we *nominally* separate out the more or less systematic electrical attractions, or chemical attractions. We may write that:- *Gravitation*...$\times$*Electricity*..., or *Gravitation*...$\times$*Chemical Reactions*.... In heat we have seen that we may use the same general formula, thus:- *Heat*...$\times$*Any more-systematized, more definite, or 'intense' phenomena*.... So it follows that if we properly select the names of the intensive factor we may similarly write, *Gravitation*...$\times$*Any 'intense' phenomenon*..., which (see §136c, where it is shown that the formula for electricity is $L^2...\times L...$) is equivalent to saying *An extensive or* L^2 *phenomenon*...$\times$*An intense or* L *phenomenon*...; and that briefly is $L^2...\times L...$, so that if we *name any* general or extensive phenomenon, such as gravity, we *imply* but omit explicit mention of the L^2 by saying *Gravity*...$\times L...$ (the *conventional* formula, in valid logic, is $F...\times L...$; IX), and then put that L^2 back tacitly by talk of the inverse square law—which shows fundamentally why there is such a law. Also, it is obvious that our naming formula is universally applicable and amounts to simply the truism:- L^3 is the naming of matter, or of *Energy*, or of the *Universe*; or, L^3 (implying T)= *Matter*=M(*varying with*)L^2T^{-2}=*Energy*. That is rigorous expression of the proof of the total argument. —— This paragraph is a series of truisms which are so obvious that it is a bit hard to stand off from them and see that obviousness.

f. It further follows in universal generality that the form $L^2...\times L...$ is a verbal representation of a spectrum; the L^2 is any 2-dimension band, and the L its relative location with respect to all the other bands (indicated in infinite regress by the dots). Further, it is then obvious that we may interchange the extensive factor and the intensive factor without doing anything but make an arbitrary change in our description (cf. §§71f, 136c). When we do that, obviously we change from static to dynamic, or vice versa; and that truistically changes the naming of directions—as we saw was explicitly the result in electricity (§135). Hence, there is *complete* rigor in our argument. Or, this and the last paragraph is a condensation of all valid logic, expressed in "material" terms, and proved by the mechanics of Part Two. It *is* rather hard to grasp such violent condensation. But those who like brevity have a sample here.

g. This section has therefore shown that chemistry is the systematic or intensive part of any phenomenon after the gravity or other extensive factor is verbally 'separated' out. Conventionally, chemistry practically is that part with reference to structures of the order of atoms. But that is an arbitrary L and T restriction; truistically, all this Part (and Part Three, for that matter) gives chemistry—as the A and analogous factors. Chemistry is obviously merely an irrational factor of a complete science—of any statement that has an intelligible meaning. Chemistry, as a branch of knowledge, is irrational alone. Similarly, so is any other special science. —— Thus, so rigorously is science actually unified that it is now proved that any branch is irrational and meaningless standing alone; so *any specialist* in one branch is forced to include other branches in some perceptible degree if he is to avoid being at least technically irrational or idiotic—or else he has to show that dualism and materialism is true, proving me to be idiotic. Of course it is necessary to have men who specialize, in the *quantitative* part of certain branches (for implicit rigorous proof of that, see discussion of division of labor, §170ko); and it is probably obvious to the reader that no man has the capacity to handle satisfactorily more than a fraction of the measures already made when it comes to definite use and detailed advance of some larger branch. But *qualitatively*, each specialist in order really to understand anything of his specialty must be able in a general way to sum his branch with all others into the One. The problem of how much to specialize—what proportion of life should be spent say in measuring the phenomena in the right hind leg of a certain species of fly, or in business in sizing up customers and estimating prices—is obviously a quantitative one, and will have a particular solution for each case. In this book I am consciously and emphatically being a specialist at being no specialist. That is a highly dangerous specialty, its follower being commonly called a Jack of all trades, and rarely being strong enough to

avoid becoming a ne'er-do-well. I do not propose to spend much of my life at it. Truistically, any man who steadily and actually narrows himself to a specialty weakens himself.

h. Explicit chemistry is therefore another library of volumes, omitted at this point. Textbook chemistry is largely a collection of empirical facts, except for Richards's compressible atoms, the Braggs' and others' work in the structural analysis of atoms (such as Thomson's and others' vacuum tube analyses, Rutherford's and Soddy's and Ramsey's work on those and on radioactivity, etc.), and the beginnings of electro-chemistry and thermo-chemistry.

i. In its ordinary arbitrary limits chemistry deals mostly with the rather systematized reactions of atoms. But clearly, there are no limits to the orders or classes of such reactions:- (1) a few atomic whirls may perceptibly more or less unite as a molecule; then that molecule is obviously a whirl, just as a star cluster, a cyclone, or an electric circuit is; (2) and analogously, two or more molecules may unite to form a higher chemical unit (and such are well known under the various names of crystals, colloids, and biological cells—of all of which, chemical "solutions" may be considered the simplest or primitive form); (3) then such collections may perceptibly rather unite as a higher sort of unit, such as a man; (4) sexes unite as couples to form families; (5) families form nations; (6) the biological cells always have some reaction or relation with the environment, and thus form a "higher" 'unit' or 'chemical compound,' the earth; (7) and the next arbitrary step, with the earth as a chemical unit, leads into "astronomy," and so on ad infinitum (and truistically we could have stepped chemically in the other direction, "down" into electrons, etc.). The third and "higher" steps above are not conventionally chemistry; but obviously a cell and a man are identically the same sorts of units that atoms and molecules are. So chemistry may rationally be extended indefinitely, the practical extension of it depending mostly upon convenience and the need to avoid specializing in a weakeningly narrow degree, and some upon the capacity of chemists. The only thing that rationally can prevent a chemist from working out the sound and applicable details of government in chemical terms is his lack of a sound grasp of chemistry—a human weakness that is forgivable but never praiseworthy. That also applies to other scientists.

§139. a. It at once follows from the last section that *we know all the various sorts of forces, or powers, or energy, or phenomena that there are, or can be.* That is merely a truism of the general formula which was established:- *Any extensive phenomena...* $\times$ *Any intensive phenomena...* $=$ *Energy.* Or, as all variously named forces and phenomena are identical, it is truistic that if we are acquainted with one we are essentially acquainted with all, and can never discover a new one. So it is impossible that there are any forces or powers or relationships in the universe now hidden from any one of us, or which can be used by some of us and not by others, or which remain to be discovered to confuse and confound present knowledge. Kings with divine rights, popes, "divinely" inspired priests and warriors, and other more or less self-deceived quacks under various names, have for ages buncoed the average honest man by substantially claiming that they were privileged with knowledge and control of various esoteric powers or forces unknown to him and beyond his control. It has now been rigorously shown that such dualists are wrong: after that rigorous proof has become somewhat generally known any pseudo captain of finance who claims to be ordained by Providence to be a trustee for the people (as one coal operator recently did), or any "Ich und Gott" autocrat or theologian can be reasonably judged to be either mentally defective or criminal. I think that most of those self-privileged aristocrats have been self-deceived (aided by the adulation of their dupes—a lot of soft-headed sheep and sycophants): they began to talk just as the pseudo-scientist does about the "stupendous forces," the "secrets" of nature that can be understood only by highly trained persons like himself, etc., and then believed their own yarns —acquired a "swelled head," conceit, egomania, paranoia (degrees of the same thing; Index, "Power-madness").

b. But of course the last paragraph proves that *qualitatively* there can be no new forces. *Quantitatively* there is no limit to the number of phenomena we may *arbitrarily* distinguish: in fact, we have seen that every structure differs quantitatively from every other, and hence every phenomenon differs quantitatively from every other and may consistently be given a "new" name. All such newly named phenomena (e. g., the recently named radioactivity and X-rays) are, as we have seen at length in terms of whirls, merely different quantitative aspects of "common" phenomena. And it will continue to be so in the future. It is possible now to describe as many such "new" phenomena as we have patience for: I could readily describe the phenomenon 'polarization of smells' (say), and show how to go about perceiving it definitely; but there is no need for such new ones unless we come on conditions in which they are useful.

§140. a. Part Two has therefore been formally summarized and proved, and shown to be identical with Part One, as the equation *Extensive phenomena...* $\times$ *Intensive phenomena...* $=$ *Energy.* It now remains to show how to apply our knowledge by describing all the possible ways of deriving energy for our use. Such application will be concrete proof of the foregoing consistently *expressed* proof—and to repeat, nothing else can furnish such final proof (§85).

b. Obviously, that equation asserts generally that the way to get available power or energy is to apply an intense or high potential phenomenon to some rather extensive or balanced parts of the universe which are truistically thus at low potential; the intense phenomenon then acts as a trigger, or releasing, force and sets off a series of secondary whirl formations. E. g., a match thus lights a fire, and is typical of all possible ways of getting "available" energy, as we shall see. —— That is a qualitative way of describing how to get energy; quantitatively, the equation asserts that there are an indefinite number of phenomena that may be used to get energy; we can never finish using the possibilities. By classifying those phenomena under conventional names below, we can see the principles of all of them, and theoretically readily use those we judge convenient—"efficient."

c. Or, we can put the meaning of that equation—of the last paragraph—in more familiar terms:- take some "natural" high potential body and put it into perceptible circuit with a low potential body, and use the resulting flow of secondary whirls over the circuit. Those terms are ordinarily used for electricity; but we shall see that they are general.

d. The chief obstacle to seeing clearly and fully how to get useful energy is the dualistic idea (explicitly embodied in the pseudo law of increase of entropy), that man himself is *not* an actual energetic factor in that general equation, but that man stands aloof from the affair (machine) and, like the dualistic theological God, "*creates*" a condition of affairs that then produces the energy. It is glaringly obvious that man is usually an important part of the whole intensive factor *Intensive phenomena...* in the production of useful energy; it is so excessively obvious that *man is one part of his machines* that science has acquired the habit of omitting statement of the fact, thus getting into so many logical difficulties that the problem has become a "mystery." All that is put into concrete, more intelligible terms in the next paragraph.

e. The galaxy whirl, considered as being fairly fluid or homogeneous, is "running down" or lowering its potential (XII). But the condensing of secondary whirls constitutes that running-down; and those reverse structures have difference surfaces in which the potential has increased. And as man results as a further working of precisely the same process, man is a condensed secondary of one of those condensations—of the surface of the earth. Therefore, each man theoretically should be of high potential (cf. Index, "Entropy, increase of"); and it is a readily observed fact that man is of very high potential *relative to his molar environment.* Or, to put it less generally but more familiarly, man persistently (i. e., through a relatively long T) produces violent changes in his environment. Other biological structures are of the same order of relatively high potential, but all of them are of considerably less degree in that order than man. That is merely a rather obviously true quantitative guess in definite terms of the view that man is "lord of Creation." Relative to our environment it is true; but in general, other biological structures elsewhere would by the theory of chance excel man. —— So man himself is the high potential trigger that is the essential 'starter' of his machines. Man himself is of sufficiently high potential to arrange any series of potentials which can occur in our environment (except that he can not *directly* do that to atoms, which have a higher main difference surface potential), in a circuit that suits himself—and he does so. Other potentials (e. g., that of a flash of lightning) may be temporarily higher, but man's potential is high enough to handle—over-top *in the long run*—all of them (doing that actually consists of man's using the atoms of his brain to manipulate the potential variations which always occur when *order* of structure is given time T to change; Part Three shows why the brain can work that way—essentially it is the ability to unify, connect, things). And man as that high potential part of his machines (his *hands* are machines, tools, e. g., as are his vocal organs) is obviously not a dualistic "creator"; this paragraph shows that his potential is itself a consistent effect of all the universe. E. g., when I write this chapter I am acting as a high potential trigger which after years may, as the result of other men's adding their potential to it, produce quite a fund of available energy in ways quantitatively somewhat different from those used now; but I am not creating that energy but am simply being consciously pushed by the whole universe to connect up things in terms of L *and* T (that same thing has been done consciously for ages by humans, under various names:- religion, science, philosophy, system, organization, engineering, government, discipline, education, etc.). I get *my* energy *from* the universe, and in all respects act mechanically —which is the same as saying that I act with rationality, or am spiritually or consciously consistent. The sloppy sentimentalist, the half-baked thinker of the dreamer type, could not support that potential: he would become bewildered, or irrational under it—his refusal to be consistently mechanical being mostly sour grapes, as I happen to know from personal experience. —— This completes the discussion of increase of entropy and the second law of thermodynamics. In this paragraph I have been acting like Maxwell's well known demon, with one exception:- I have been getting energy consistently, whereas the demon, like his inventor in this matter, was capricious or dualistic like the theological God or devil. In short, Maxwell could not solve the One and Many so he invented a hypothetical dualistic God for science:- his demon —identical with theological ones. Such a God is now obviously an offensively "materialistic" nominal link in a disorganized machine that is hence not really a machine and will not work. By the simple process of observing the (to us) most obvious thing in the world—man in his glaring capacity of being a high potential trigger: man as a fierce, enduring, keen, strong animal, or organized real machine or person,—and seeing it (him) as it is, we know there is no need for such puerile dualistic Gods or demons. And as we saw in §47, and see again here by considering that an arbitrarily skin-bounded man *really* connectedly extends from *Intensive phenomena...* to the total One *Extensive phenomena...* $\times$ *Intensive phenomena...*, man ultimately is the whole machine or person, the real God or universe—that being a self-respecting statement of the truth not grasped by the mentally weak dualists who would truckle to a kaiser-like God and whine to him to save their nasty little personal souls.

§141. a. It therefore follows from the last section that to obtain utilizable energy the general process is to throw a collection of available structures out of equilibrium, and let the secondary whirl formation accumulate as molar motion of lower potential, which molar motion we use in a reverse cycle, or as "available" energy. Any size structures will do; but for convenience we will talk of atoms:-

b. I shall give a general description of *combustion*, as being typical of all such methods. Combustion is always started by relative motion of two or more atoms—frictional rubbing of each other. So some degree of combustion is truistically a universal phenomenon, being merely mutual motion *producing secondaries.* Conventionally, combustion is such rubbing done long enough and violently enough to produce rather violent secondary whirl formation, and usually to cause such a resulting aging of the whirls (wearing out of their fields and increase of internal condensations) that those condensed whirls in some degree combine (usually "chemically" in our "combustion," as O and C into CO_2), and in that combining throw off even more violent secondaries, some of the energy of which keeps up the combusting. That also builds up large and intense fields around the structures, and that causes the collection to expand (or to transfer that expansion over some sort of 'circuit' to neighboring collections), and we use that expansion or molar motion as "energy."

c. That general sort of conventional combustion has various names that indicate quantitative differences. When the rubbing together of fields is done in such a way that the atoms more or less systematize their expanded fields the result is called electricity. And in such combustion (which usually is not carried far enough to "burn" the rubbing substances) the systematized expanded field, the magnetic field, is transferred by a circuit of atoms (in wires) and is directly used to produce "mechanical motion" by pushing other wires arranged as a "motor." However, that field may be used to joggle atoms violently (as in a lamp filament), and it then produces ordinary combustion (atoms like O that will combine with the lamp filament readily and accelerate that combustion are kept out, so that in *one* sense that combustion is slow); or, more conventionally, it produces *heat.* —— It appears from this paragraph that the way to produce electricity directly from heat (even where there are slight differences in temperatures) is to systematize the relative atomic field motions. It is thus theoretically exceedingly simple to do; in fact it automatically happens in a small way in thermo-couples. But the practical quantitative solution of the problem involves acquiring knowledge of the actual structures of some atoms, difficult measurements, and the usual process of trial and error in the numerous directions in which measurements do not at first reach definitely.

d. Ordinary combustion of C and O into CO_2 produces what is usually called a change of state. I. e., if we burn coal, by some method (ultimately friction) we "start" the fire. As seen above, that causes violent secondary formation

which accelerates and spreads the "fire," and increases the various atomic fields, until in this case they expand into a gas. They are said to change state. That increase of volume is molar motion which we may use (par. b). The expansion may be used directly in the cylinder of a gas engine to push the piston; or the jolting of that secondary formation may be conducted through the walls of a boiler to water, expand it to steam which is transferred to a cylinder and pushes the piston. Etc. —— So I am using *combustion* in a general sense that includes both "mechanical" energy (i. e., volume, surface, and kinetic energy, and transferred or 'conducted' or "potential" sorts of those, such as waterfalls, winds, etc.), and so-called non-mechanical energy (i. e., heat, magnetic and electric, and chemical energy). Obviously no other consistent qualitative definition is possible.

e. So all "changes of state" are capable of producing available energy. That is a repetition in familiar terms of par. b, where it was expressed as change of order of whirls. Such changes change potentials, making "energy" available.

f. A general illustration of the essentials of a "match" may be given in terms of low temperatures:- Obviously, if a collection of atoms is steadily reduced towards "absolute zero" of temperature, it is truistic that their fields are steadily weakened and the atoms become more and more aged and cluster-like (that is proved by Onnes's showing that their electrical resistance is decreased to a point near "zero"; XIV). Truistically no actual zero can be reached; but if the atoms were subjected to the very low temperatures for a long enough time the clusters would evidently begin to combine, releasing comparatively violent energy as a nova does, and expanding. That expansion would be combustion, started by "cold." It would perhaps, with many sorts of atoms, be of "explosive" violence—faster than an ordinary "fire." If element structures had been used, quite likely temporary new elements would form by that process; etc. The process up to the explosions is the reverse of radioactivity, and the explosions would be radioactivity, although perhaps of much different intensity. It is in principle analogous to the process that causes volcanoes (§122). That extreme cold is a trigger or match more intense than the ordinary match. The fact that electrical resistance *suddenly* drops considerably at a low temperature is crucial proof of this paragraph.

g. In the same general way, if any atom be subjected to sufficiently violent action for a short time, or to less violent action for a relatively longer time, the atom will break up into parts (if there is no relatively heavy confining pressure or other means permitting the atom to 'recuperate'). Radioactivity is obviously one form of combustion. In it the atom breaks up to a greater extent than in ordinary combustion: so the available energy is relatively great, and ordinary methods of starting a fire have, in the *short duration of time* in which they have been applied, produced no perceptible effect in changing the speed of such radioactive combustion. But if the comparatively few atoms in a vacuum tube be subjected to the rather violent and direct jolting of electric currents, they are perceived to break up in various ways. That breaking up is analogous to radioactivity, and truistically releases relatively large amounts of energy: so far as I know the release of such energy has not been experimentally measured. But it is obvious in principle that the vacuum tube and analogous devices will serve as a match to start ordinary atoms to burning (breaking up), and will thus give available energy from atoms that nowadays we do not use for "combustion." Again the principles of burning *any*thing are simple; the quantitative problem of getting some combination of atoms which will give such energy that is economically profitable is a difficult one. But by the time coal runs out something much better than coal can readily be devised.

h. The speeds in atoms are of the order of V_1, and so a comparatively little breaking up of atoms gives relatively great energy. Ordinary combustion, in which the degree of secondary formation, or breaking up, is so slight that it is exceedingly difficult to detect any change in the weights, e. g., after the atoms have been burned, gives an amount of energy that is great compared with usual standard *molar* energy. If we could break one atom *totally* up, into the absolute infinite regress of parts, there obviously (as we saw before) would come from that atom an infinity of energy. But the practical, pluralistic fact is that it would take an infinite potential to do it (or use up infinite time, if we use a lower potential)—and man can not command anything like such a potential (or time) in practice. The obvious fact is that there never is going to be discovered any "cheap" and easy method of getting at the vast stores of energy that are in atoms. There is an irresponsible sort of quack who, in praising the flabby folks who have become too weak to work over 44 hours a week, implies that all we have to do is to discover some sort of hocus pocus, and then sit on flowery beds of ease (something like the theologians' various parasitical heavens), and casually tap an atom and get anything we want. But no one will ever get anything which he does not pay for *exactly* and in full. Anyone who tries in any respect to "beat the game" is mentally defective (XVIII).

i. The source of high potential energy most available at the present time is the radiant heat energy of the sun. Possibly no other general source of energy will ever be used much by man. Anything which that energy will make grow (or in the case of "inorganic" matter such as water, "expand") may, if suitably arranged, be used as an accumulator or storage battery, which later on is comparatively rapidly discharged. Coal, oil, alcohol, natural gas, wood (any organic fuel), foods, and water and wind power are examples of such sources. Even if we found it expedient to burn (say) sand, we most likely still would use some of those forms of sun energy directly as a match (and more remotely, the energy in that sand may be said to be stored there by the sun; XII). The principles of such energy utilization as regards "expansion" are already known and applied to a considerable extent. And the direct utilization of "growth" is obviously simple in principle. The most of growth on earth is ultimately due to a chemical reaction in chlorophyl (so far as is now known), by which C is taken out of the air, usually more or less directly from the products of previous combustion, and combined with other atoms in less stable combinations, the sun's radiation furnishing the energy required. As there is comparatively little chlorophyl distributed over the surface of the earth, but little of the sun's radiation is thus stored. Several times more radiant energy falls on the Sahara desert than is released by all the coal burned in the world during the same time. It is a quantitative problem to devise a chemical structure which we can manufacture, transport, and use in any location at any time, to store up that sun energy. It is truistically possible to do it; but by the principles of harmonic periodicity it may not be profitable.

j. Those applications fundamentally depend on a quantitative knowledge of atomic structures. And this Part of the book, from one point of view, has undertaken to show *how* such knowledge may be obtained.

PART THREE

SPIRITUAL UNIFICATION; or HUMANICS

CHAPTER XVI. *Biology.*

§142. a. This last Part will describe perceptibly organized or systematized collections of atoms, with reference (1) to their relationships with the remainder of the universe; and with reference (2) to their relations among themselves; and (3) to their own internal relations between their own structural parts. Or, in terms of our naming formula, we shall see respectively the expansion of the specific points of view:- (1) *"Material" Environment...×Organized or Living Matter...*; (2) *Other Organisms...×A Given Organism...*; and (3) *Other Organs or Parts of a Given Organism...×A Given Organ...*. —— I shall not trouble to treat those obviously exhaustive heads with any formal separateness; (2) and (3) are clearly conventional forms of standard universes; and other similar standard universes will be considered —all of which will always *imply* the complete (1). In fact, I chiefly take the single organism *man* and discuss him as being of primary interest to us—it being understood that the more complete formulas are thus implied. Therefore, because this Part is chiefly concerned with describing a standard universe:- man (and mostly a smaller one that represents him:- his mind or nervous system), it is called *humanics*—a poor name perhaps, but the best I could find.

b. I stated that we had to deal with 'perceptible organized or systematized collections of atoms.' All atoms are organized with their fellows—meaning simply that all are related, continuous, reacting. So when we here discuss *perceptibly* related ones, the only difference this Part has from One and Two is that some difference in L and T is implied. And I do not know definitely how much that difference is: no one has ever said explicitly how much, so the reader can please himself as to whether he will say that the atoms of a brick are perceptibly to himself organized—whether he will say the brick is alive. It is usually tacitly agreed that the atoms of an electric circuit are organized or systematized perceptibly; so there is no essential difference and not even any conventionally *definitely* asserted difference between an electric current and a "living" structure. —— That impossibility of making a sharp distinction between living and not living is more explicitly shown in the rest of this chapter. Here we simply note than any *general* statement or implication of the nature of "life" promptly shows that there is no dualism or real difference between living and non-living matter. So the total universe is alive or is life; and we may write a general statement:- *Imperceptibly organized matter...×Perceptibly organized matter...=Life.* For truistically life in general or *Life* is possible *only* when perceptibly organized matter is supported by—inseparably related to—imperceptibly organized matter. It is the problem of the One and the Many in terms of "life," and it is not necessary to repeat the solution here more explicitly than is given by that condensation in the last sentence. —— So the only general problem as to what it is that is "alive" is a quantitative one of *how much* evidence of organization we want. I shall take it that everything is perceptibly to me alive; when I wish to put other quantitative limits on what I say is 'alive,' I vary those limits as convenient, and as implied by the context.

§143. a. When we describe the universe in terms of the naming equation *"Material" Environment...×Organized or Living Matter...=Life*, or *Universe*, the description is conventionally named *biology*. The *Living matter...* term is the intensive factor; and as we implicitly saw, conventional biology emphasizes it, by making it a standard universe in which *Environment...* is usually merely implied. Obviously, all particular sciences follow a similar procedure. But, in agreement with the pseudo principles of classic logic, men formerly failed to recognize that the dots or infinite regress had to be in that general equation, as indicating that there was no essential difference between *Environment...* and *Living matter...*: and they therefore asserted that living matter or life was an absolutely separate, dualistic "creation," and that living matter was endowed with "*vitality*," and environment essentially or absolutely was not. Then, to retain classic logic consistency, those "vitalists" had to hold that each species had an absolutely distinct variety of that vital principle, and hence existed absolutely distinct and separate from its absolute creation. But that was glaringly contradicted by facts, as was finally overwhelmingly shown by Darwin and others. So the theory of evolution (§145) asserts that our biological equation is right, and supports this book.

b. But conventional science still holds that its "present state of knowledge furnishes us with no link between the living and the not living" ("Ency. Brit.," Art. "Biology"), and that assertion (which the doctrine of evolution truistically repudiates) is a sort of half-hearted surviving trace of vitalism. So I shall explicitly show (§144) the identity of living and not living matter.

c. It is obvious, and will be made explicitly more so in various places below, that there can be and are numerous perceptibly different organized structures; and that they are often made up of perceptibly different smaller parts, such as organs, cells, parts of cells, etc. Over a million species of "living" things are actually distinguished. As a result, and also because of the classical logic view that each species is a unique quantity, no definite biological quantitative standards are agreed upon; we saw that there is no agreement on the fundamental one:- of how much organization constitutes "life." So for the biological sciences there is not any general formulation of the measuring member $M(\textit{varying with})L^2T^{-2}$ (but cf. §148). Obviously, such measuring members may be formulated and used at any time people wish to agree upon standards; the theory of it is given in IX, and below such extensions of present science are occasionally implied. In the biological sciences it is usually readily perceptible that there can be no exact science (cf. Jordan's Introduction); that fact has long been observed, and some scientists term the sciences in Part Two the "exact" sciences, and humanics the "inexact" sciences. Some of the intemperate experimenters of the German Landolt's type (§137), who tend to materialism, rather hold that humanics can not be made science at all—which is throwing the baby out with his bath on a large scale; on such a large one that those "scientific" 'inhumanists' can not see their ridiculousness. The intelligent reader sees that the biological sciences are, truistically, as susceptible to "exact" measurement as any other, but are more difficult in the only sense any science may be difficult:- so many details are perceptible that memory becomes overburdened, and some confusion may result.

d. Perhaps the simplest way to use measures *generally* in the biologic sciences is to use the formulas of Part Two, applying them to collections of atomic galaxy whirls making up the biological cell. I may briefly describe the quantitative complications that could ensue:- The molecules of what is usually considered to be living matter are each composed of an average of 1000 atoms, as a reasonable estimate. Thus there are (say) 1000 stellar galaxies in mutual combination and reaction, as one biologic molecule. Then there are numbers of those molecules which go to form a rather stable or static structure called a crystal; and numbers that form a more dynamic colloid; and numbers of such crystals and colloid structures go to form a biologic cell. (That cell itself often perceptibly exhibits the same two contrasting parts, the nucleus, and its surrounding more dynamic or colloidal protoplasmic substance—the two corresponding to the two parts of a machine, or to the filament and field of a whirl. The cell itself often has other condensations that are perceptibly variable—showing that the parts of such a machine start on the infinite regress.) As a reasonably low guess there are something of the order of 100,000 of those large molecules in an average cell—giving 100,000,000 stellar galaxies (substantially as a minimum) in one cell. And it is estimated that in one man there are about two billion cells in the nervous system; so if the cells of the nervous system are of average weight there are perhaps in a man a total of something over a hundred billion biologic cells—giving us far over a billion-billion equivalents of stellar galaxies in one man. So if I were to describe a man with the roughness and indefiniteness which was required in XII to condense the description of the stellar galaxy to 25,000 words, I would need at least 25,000 billion-billion words—and that rough description of a man would nearly surely fill more than ten million times all the printed paper now on earth. —— If we applied our measuring formulas in any such definiteness the result would be unmanageable. But because a cell is in general equivalent to a single whirl, and a collection of cells into an organ makes the organ equivalent to a whirl (§981), and because organs react together as *That*...×*This*..., we could use our measuring formulas (use *L* and *T*) with respect to cells or organs. —— At any rate it has been made generally obvious that there are enough different parts *perceptible* in a man to make it truistic that he will exhibit many phenomena. And it is perhaps equally clear that if we had not first seen the elementary descriptions of single structures—the easy ones of "physics"—we would be nearly incompetent to describe man.

e. So I shall expand biology by considering those various *That*...×*This*...'s, thus *implying* the *L*'s and *T*'s of the measuring member. If we take the factor *Living beings*... as a standard universe, the chief useful conventional expansion of it is that of mental and physical:- *Other physical organs*... ×*Nervous system*...=*Body*...×*Mind*...=*Living beings*. That is substantially an *internal* division of organisms, giving the conventional sciences *physiology* and *psychology* (and obviously leaving *Environment*... more or less implicit). But it will be seen, if it is not already obvious, that no method of splitting the biologic *That*...×*This*... into its various dots is conventionally followed which is based upon any consistent principle other than the *immediate* usefulness of it. Clearly, any number of ways of dividing humanics into branches could be devised. But I shall follow the usual method of making those immediately useful divisions. —— What is at present immediately useful will not long be so; my guess is that biology will superficially change enormously in a century. But the formulas given, explicitly imply expansions needed in the future. However, humanics is such a vast subject that there is not likely to be any general agreement soon as to the best ways of splitting. It is of course a quantitative problem; but as we are intensely interested in ourselves, violent controversies will continue—indicating that "inexact" scientists are still alive, vigorous, and capable of learning.

§144. a. It is orthodoxly held ("Ency. Brit.," "Biology") that the uniquely distinctive properties of living matter are these three [in this paragraph I practically use the words of that article, and they are not very precise]:- (1) Living matter has a *chemical composition* that "invariably" contains C, H, O, and N in complex compounds (called protein or albumen), united with a large proportion of water, and as such, in its primary unmodified state, known as *protoplasm*. (2) It "universally" disintegrates and wastes by oxidation; and concomitantly grows or reintegrates by the intussusception [imbibition, intercalation, interpenetration:- eating, in short] of new matter—an addition of new matter not to the surface of the living mass, but by interposition between the existing molecules of the latter, and hence differing from agglutination or accretion to the surface in the manner in which a crystal grows. (3) Living matter perceptibly undergoes cyclical changes—in the ordinary course of nature all living matter proceeding from pre-existing living matter, in well known cycles of birth, growth, and the cessation of the existence of that individual. —— To quote verbatim:- "But in addition to those distinctive characters, living matter has some other peculiarities, the chief of which are the dependence of all its activities upon moisture and heat, within a limited range of temperature, and the fact that it usually possesses a certain [a perceptible] structure or organization."

b. The general defect with that argument that living matter is absolutely distinct from non-living matter is that it is taken for granted without proof that all its quantitative words are perfect or absolute (that all its observations and experiments are exact), whereas not one is, or can be. E.g., there is no perfect intussusception and no perfect agglutination; even the electron theory, which was generally accepted when the article cited was written, holds that in some degree there is always a combination of the two ways of increasing. (*If* the writer did not hold that electron theory, then he should have stated *how* he considered the two ways possible—for otherwise he could not be regarded as having said anything.) —— This matter of disproving that particular orthodox vague jumping to "sharp" conclusions is itself scarcely worth the space used by this paragraph of general disproof. But this paragraph, appropriately changed verbally, directly destroys all classic logic arguments wherein sharp essential distinctions are asserted—and in such generality is useful, even though merely destructive.

c. It will now be shown explicitly why all matter is living. Conventional living matter is matter perceptibly organized within that narrow range of conditions, the organization being evidenced by its having those three characteristics. In brief, given on earth a certain rather narrow equilibrium of conditions, which has existed for the long time needed (long because narrow), we observe that certain chemical elements get into rather elaborately organized states. By every way in which the principle of continuity or relationship has been stated, that result is *essentially* a truism with the conditions. By every principle, we would expect such "living" matter to exist: given certain sorts of elements time enough in fairly steady conditions they truistically must organize. It is truistically inconceivable how there could fail to be "living" matter. Of course, the problem of why there are the now actually existing quantitative sorts of living forms requires for its solution the whole history of the earth: Darwin and his successors have been giving much of it. *All* of such

quantitative description can not be given, as it involves the infinite regress. But this whole book shows that, given conditions quantitatively steady enough, perceptible molecular organization into "higher" and "higher" orders (e. g., solutions, crystals that are gaseous or liquid or solid, colloids, protoplasm, nucleuses and cells, organs) truistically occurs. And just as there is no sharp line between a primary and a secondary whirl (§101e), similarly there is no absolute distinction between atom, molecule, solution, cell, organ, and so on ad infinitum; they pass imperceptibly from one to another, as we shall see in more detail from time to time. —— For a more explicit and detailed statement of how life could "originate" on earth, see Chamberlin's "Origin of the Earth," and Moore's excellent "Origin and Nature of Life"; also Bastian's "Origin of Life," which is disputed.

d. By the principles of periodicity, it is obvious that the quantitatively harmonic elements on earth tend to organize themselves into one 'elementary' combination of the next higher order (into perceptibly living matter), just as the solar system organized by Bode's law, etc. Conventional "living" matter on earth is therefore one perceptible alive 'element' out of many possible such 'elements' which occur in various environments; i. e., our protoplasm (mostly of C, H, O, and N) is one element in a periodic table of alive ones. And that is obviously theoretically true and necessary:- For suppose that conditions on Jupiter are now steady enough for some colloidal formation that will progress into a cell. Then if that cell is going to be strong enough to withstand the greater gravity pull of Jupiter (to give just one instance of a collection of harmonious conditions there, which differ *quantitatively* from those here), the elements of the cell would be heavier and stronger, by our measures *here*, than our C, H, O, N are. Possibly C would be replaced on Jupiter by something as strong and heavy as *our* Fe; the Jupiter C—which is quantitatively not our C—would perhaps be thus strong, measured by our standards. 'Protoplasm' on Jupiter would still bear *about* the same quantitative relation to Jupiter's periodic table that ours does to our table; but by the principle of asymmetry, Jupiter's would be somewhat out of step with ours so that the intervals in it between elements differ from ours. And if conditions were relatively more unstable on Jupiter than here, probably there the Jupiter-C would be replaced by Jupiter-Si (say). It is likely that in more violent past ages here, protoplasm mostly contained Si instead of C (in short, there truistically are 'species' of "living" matter, although possibly there is only one such 'species' or 'element' existing in our present conditions). There is some evidence that the chemical composition of "living" matter here is not so sharp as asserted by the authority cited in par. a (cf. Bastian, "Origin of Life," XII).

e. So there is nothing absolute about the chemical composition of "living" matter. Such matter follows the principles of all matter in orderly organization. Probably some perceptible degree of "living" organization forms in some level of the surface zone even in such comparatively violent bodies as the sun. Such protoplasm would probably be much different from ours. —— The basis of the protein of the earth protoplasm is an amino acid, the molecule of which may be said to be acid *at one end* and alkali at the other—chemically analogous to the two poles of a magnet (Moore, "Ori. and Nat. of Life," 116). And obviously, such an atomic electric circuit is alway possible in any conditions, but would truistically with varying conditions vary in its constituent elements—just as vice versa any "element" is magnetic if we give it proper conditions (XIV).

f. The second so-called absolute characteristic of living matter is said to be (par. a) that it wastes by oxidization, and grows by interpenetration. That obviously means in general and consistently:- (1) that if we have under certain conditions a given perceptibly organized matter, it will, analogously to a whirl, give off secondaries of a certain sort (which in our protoplasm, in quantitative agreement with conditions, happen to have an increased number of O atoms—are oxidized); and also (2) that the same organized matter will, like a whirl, take in secondaries, and perceptibly distribute them internally. There is evidently nothing essentially unique about that process, as it is the *only* process (it is reversible, of course) which can occur with *any* natural structure—as shown in all of Part Two. —— The authority cited omitted explicit mention of the fact that that oxidized *waste* also is of an intussusceptible character—but again not perfectly so.

g. And the third alleged unique feature of living matter (cyclic processes) is obviously nothing more than a repetition or truism of the fact that there is both waste and growth. The two (waste and growth), as a harmonic periodicity depending on the relative sizes and numbers of the inner structures of the given structure, as in all other kinds of natural structures (Part Two) accumulate into a certain vibration or rhythm. Ether cells, by the same cycle, were said to give off "light"; obviously, these biologic cells by the same principles 'vibrate' (incidentally, certain sorts of waves are therefore, by the mechanics of XIII, given off by living cells—which waves are truistically sufficient to explain telepathy, mind-reading, and similar phenomena; cf. §146). So again all other natural structures have the same processes as "organic" ones. The difference is the L and T of cycles.

h. It further follows by the same principle of harmonic periodicity that a certain internal structure of a given live cell, in agreement with its environment follows a certain course of growth and waste. I. e., for a given mass of protoplasm, forming a biologic structure, and considered as a standard universe, we have the equation:- *Environmental structures...*$\times$*Live organs or structures...*$=$*The life of the living being.* And that truism asserts all the general principles of heredity—asserts that quantitatively both acquired and inherited characteristics go into the living being and are transmitted by him or it. The equation further asserts all the general principles of the size and form of the living being, and thus determines the species. If we expand that standard universe to include all such perceptibly "living" beings, we have:- *Environmental structures...*$\times$*Live organs organized as all living beings...*$=$*Life.* And that obviously valid equation asserts the principles of formation of "living" beings from so-called dead matter, the variability of all species, etc., ad infinitum. Or more specifically, to revert to the first of this paragraph, the so-called principle of *biological teleology* (that an organism is *fitted* to its environment so well that it seems to be "designed" or "purposed" for it,—"Ency. Brit.," xxviii, 1024; for teleology, see §86) is more correctly expressed by *completing* that "principle," and saying that the environment is also in harmony with the organism:- for our truistic equation asserts that *both* the environment and the organism (or organisms) react on each other to produce, monistically, a perfect fit. In short, Darwin's "mechanical" explanation of the observed fact that there are no constant species, which explanation is expressed by the phrase "natural selection" (or Spencer's "survival of the fittest"), is obviously a truism. Darwin's phrase perhaps tacitly emphasizes *Environment...* too much (and Spencer's, *Organisms...*); for the balance is *continuous* or dynamic—*mutual* between environment and organism. So, as the principle of balance or "fitness" is universal (being merely the dynamic balance *That...*$\times$*This...*; §114c, IX), applying equally in the form or name 'no constant atoms,' "no constant species," 'no

constant anything,' or 'no exact science,' therefore I express it in those ways and finally as 'harmonic periodicity,' which has been shown to apply to biology. —— That ultimately absolutely unifies biology with other sciences, and indicates the complete quantitative theory of humanics.

i. In discussing living cyclic processes in par. g it was implied that there was birth and death. Incidentally, as it has been proved that the cycle is the same for all natural processes or structural *parts* of the universe, the fact that those two everyday names for the "ends" of the cycle are not the same is direct evidence that it has been observed, and may be, that no cyclic process *of a part* can be exactly repeated—that no cycle short of the universe is perfectly reversible (Index, "Cycles"). —— Classic logic views of birth and death are that they are sharp, exact, absolute processes—that before birth the organism did not exist, and at some exact time (the birth) it came into existence, and then ceased to exist at some later exact time (its death). The obvious fact is that there is no such definite thing or time as birth or death—they are *L* and *T* words which roughly and without much exactness apply to a given living being (§80m). It is not possible, as shown in Part Two, to give any exact space and time for the formation of *any* secondary, or its subsequent consolidation with something else—for its birth and death. It is now directly observable that we can not say exactly when an organism is born, or where; or when or where it dies. There is no agreement as to whether a chicken is born when the sperm cell and ovum unite, or when the egg is laid, or when it hatches; and even if there were such an agreement, obviously it takes time for the cells to unite, time for the egg to be laid, and time for the chicken to peck out of the shell, each of the three being just as surely a time and space process as "life" itself. And physicians are not agreed as to when a man dies; and if they were, the facts would refute the *accuracy* of the agreement:- often all the larger organs certainly perceptibly cease to work, and after that ordinary "death" the man is resuscitated; various organs are perceptibly kept alive away from the remainder of the body; when the "man" dies his organs are in some degree still alive (e. g., his hair will often continue to grow). In short, birth and death in any exact or in any essential sense are names like zero and infinity—One words that name a *limit*, and apply to nothing quantitative or scientific (to nothing that is exressed in *finite* terms), or to nothing in our *personal* lives. Birth and death when scientifically or pluralistically used signify merely some arbitrary quantitative measure that is roughly guessed at as a matter of convenience and are nothing essential or constant; e. g., a man's consciousness, or what might be called his own personality or actual self which is perceptible to himself, obviously by no means is born and dies coincidentally with his "physical birth and death"; also, as far as *he* perceives, his self dies and is born daily at the beginning and end of sleeping soundly. So obviously, there can be no possible agreement, so far as his *own* perceptions are concerned, between a given man's guess and that of others as to his own birth and death.

j. So the obvious rigorous explanation of "birth" and "death," as being things supposed to be absolute entities, or absolute processes really different from any other processes, is very simple:- there are no such things, and no explanation is needed. The reader will say, that notwithstanding all that talk, he will die. Of course he will, in the customary sense (but see §146lm). But *he* has never existed as something uniquely separate and distinct from *any* other thing, and so he obviously, as a mere truism, can not absolutely cease to exist when he does not previously really exist —but will keep on in the future as he has in the past, bearing continually changing quantitative relations with all other things. When he says he dies, he means that some certain degree of change of relations occurs:- *what* that degree is has not been measured, and can not exactly be, and varies for each man anyway. He has been having changes of relations all his "life," and each one is a *unique quantity*; hence his death is not in any essential respect a new thing, although it too is another unique *quantity*, with which he is perceptually quite familiar—having become so from having experienced a process *im*perceptibly different from it in going to sleep thousands of times. —— The theory is obviously rigorous. I also happen to know from experience what I am talking about, as I was physically, mentally, and medically dead once, and was resuscitated. When I was a boy I wanted to know how chloroform worked: so as usual in similar cases I tried it on myself; and I accidentally killed myself. The reader may verify the experiment himself if he likes. —— I have used more space for birth and death than the intrinsic difficulty of the problem warrants. But such emphasis seems to be required because orthodox theology revolves so persistently about death. Obviously, the way to remove the reputed sting of death is to know precisely what is meant by death. The theologians have held up death as a horrible bogey, just as a peculiarly stupid nurse frightens a child with the dark—the nurse usually, as an automatic punishment called "poetic justice," coming to fear it herself. There is no such thing as the theological dualistic death from which the theologians promise to "save" us—if we will be "good" by doing as *they* order, and turn various privileges, powers, etc., over to them. Since I died I have had no fear of death (and the theologians messed up my nervous system considerably when I was younger); often when I persistently overwork I find that it would be a great relief if I knew I could at once go to sleep permanently. I have no doubt that Metchnikoff ("Prolongation of Life") is correct in saying that it is a fact that people who grow old normally (balancedly) desire death. Certainly his principle is correct, though not always stated consistently. We take up the subject, under "immortality," later (see Index).

k. This section, particularly par. h with its formulas, outlines biology explicitly. I now proceed to expand some of the more important aspects a little, starting with evolution.

§145. a. We have seen that the modern doctrine of evolution is in effect the equation *Environment...*×*Perceptibly living species...*=*Life, or God, or Universe*, and hence is identical with the argument of this book; and implies the use of the valid logic (the doctrine almost explicitly asserts the use of such logic, in that "natural selection" is orthodoxly admittedly a truism, or circular reasoning); and explicitly uses "mechanical" or positive language; and admittedly sums into the principle of continuity, or universal relationship (see Jordan's, Ritter's, and Patten's books). Of course, various materialists and other sorts of dualists have perverted the meaning of *evolution* into almost every sort of pseudo doctrine. It would probably be a waste of time to consider explicitly those perversions, except the most pernicious one (par. c):- that natural selection means "might makes right"—means a continuous "fight" for existence, universal "repulsive" *force*, a nature red in tooth and claw, and all the rest of that Nietzsche - Treitschke - Bernhardi - Bismarckian "blood-and-iron" unbalanced attempt to run one irrational factor to infinity. However, if any reader prefers to take it that one of those perversions is orthodox "evolution," then he may name the rigorously consistent principles given here anything he likes, and take it that I reject such orthodox "evolution."

b. The valid logic was not explicitly stated in past attempts to say what evolution meant (although Jordan, Patten,

and Ritter clearly used it). But obviously, the important points shown by Darwin and others to be proved by the observable facts may be stated thus:- (1) all observed species vary or are not constant (implying the infinite regress from the biological point of view); (2) each creature and-or species varies as a result of interaction with its environment, that environment including other creatures and species as well as "non-living" bodies (that implying the infinite regress from all other points of view); (3) and all that is considered a mechanical or positive way of understanding the whole universe, in terms of "life." —— That is clearly directly equivalent to our equation *Environment...×Perceptibly living species...=Life, or Universe.* And equally obviously it is identical with the total of what was proved in Part Two:- *All other atoms...×A given atom...=Universe;* or with the *That...×This...=Meaning* of Part One. Species are more easily perceptible, as being natural structures, than atoms are; so the general unification of science naturally took place first in a fairly definite way in biology—as "evolution."

c. But classic logic implies that there is a linear series of facts that proceeds in a non-circular manner from an absolute "lower" to an absolute "higher" (whatever that may mean: the "high" aristocrats seem to think they know, but cf. Index, "Direction"). So the aristocrats (who considered that men also proceed thus in absolute order of class caste from peasant to kaiser) ignored, or were too defective mentally to see, the fact that any living structure *reacted* with its environment (implying *both* attraction and repulsion, depening solely on point of view [Index, "Direction"]; and also obviously implying that even the environment is as "good" as the king, or has structures essentially the same). They jumped to the unwarranted conclusion that evolution was represented by the pseudo, unfinished 'equation' $Living\ structure_1\ Living\ structure_{2,3,4,\text{etc.}}$,—quite analogous to the unfinished materialistic 'equation'—interpreting such 'equations' to mean that there is an absolute order of caste, so that as a truism of such dualism those presumably "higher" in the scale always try to push down or back, or fight, those "lower." They took the phrase "survival of the fittest" (§144h), and instead of interpreting it correctly as a circular truism that means a *mutual* give *and then* take in infinite regress, they assumed the customary arrogant, selfish, or cruel premise of the aristocrat (who when very aristocratic is the pathologically insane egomaniac—or when no perceptible nerve lesion exists, paranoiac), that *they* were the fittest or best, and concluded that therefore they must follow the law of evolution by fighting the others. Now, obviously, from a One or infinite point of view, such an argument of repulsion can be quite true, just as we saw Reynolds's pressure to be. But it would largely capsize ordinary language to apply that sort of language to finite individuals—our ordinary language uses *both* the One 0 *and* ∞, action and reaction, repulsion and helping (§114c). But the aristocrats didn't have the intelligence to see the absurd contradiction, while pretending to speak ordinary language, of making evolution one irrational factor always acting in one direction. So they and their dupes fancied that along the road "might makes right" they were becoming "supermen"; but obviously they were merely proving the truth implied in the old adage:- whom the gods destroy they first make mad. —— All aristocratic doctrine, when put into humanistic form, primarily holds that there is a real order of caste in men (fixedly separate or discontinuous), and that the aristocrat is the best, or the essentially superior, or the divinely ordained or "called," or the partner of Gott or Jehovah, or the otherwise *privileged* person (getting something for nothing—a truistically impossible action without a reaction). Every such doctrine is at bottom wrong—as I trust I have made so glaringly obvious that even a mild aristocrat will have enough mental capacity to see it (and of course thereby automatically cease to be a dualist). But it is usually not possible, by the use of so mild a force as words, to "convince" the very defective brain of the "higher" aristocat, such as a kaiser or a hysterical woman.

d. Taking the simplest view that everything is alive, natural selection means that all parts mutually react, just as the organs of a man's body act together. Certain parts are of course *rejected* from a given place; but that equally implies that the part is *attracted* to another place. There is ultimately exactly as much pluralistic repulsion or the conventional "force" or "fighting" as there is attraction or the conventional "love" or "peace." There is no need to carry the first to the degree of internecine warfare, or to carry the second to the degree of deadly stagnation or boredom; an excess of one is, by the principles of action and reaction, as bad as an excess of the other (§§114c, 163b).

e. Because the valid logic implied by the rational evolution was not definitely stated, conventional science explicitly recognized as an unsolved problem a biological form of the One and Many:- whether (1) variation in an organic structure is *inherent*, or proceeds from "within," or (2) is *acquired*, or comes from "without." Obviously, (1) asks whether the structure is an absolutely separate universe, not affected by other adjacent universes, and (2) asks whether it is continuous with the single universe, so that the "without" can affect it. That obviously asks whether the Many or the One is true: it is answered by Part One. The specific, practical answer here, in biological terms, is that the ordinary live structure *itself* contains perceptible parts, which produce *some* perceptible variations from within, just as if the structure were a little universe (i. e., incommensurability truistically applies within the structure); also, variation must similarly (in some quantitative degree) be acquired from without. As a matter of observed fact, both sorts of variation seem to occur perceptibly, although it is disputed; and obviously, if both sorts thus occur, that directly shows that circular reasoning is valid, and that there exists also the inexactness of the infinite regress thus implied. And as both those contradictions to the classic logic were more or less evident to biologists, they hesitated to admit that both sorts of variation were possible: they were in the same dilemma as Van der Waals (§82). But the biologists (except for Jordan, Ritter, Adami, Patten, and a few other first class thinkers I do not definitely remember) were not so clear as to what that fundamental difficulty was (although in a vague way the problem is given as "bathmism"; "Ency. Brit.," x, 36). And they have stated the problem less broadly:- whether acquired characteristics are inheritable. We take up that problem, in the less general terms of heredity, in §147. In that form it is turned into the One and Many problem that has recently been named *Mendelism:*- the more fanatic, materialistic Mendelians hold that each character or property of an organism is an absolutely separate unit (an absolute biologic 'atom')—that the Many is absolute.

f. That covers evolution generally. Obviously, by expanding the general evolution formula (naming the dots), "evolution" becomes coextensive with humanics—with all of knowledge, as all things are alive. So if the reader does not like the particular names I have used in that evolution equation, he has an unending choice of names just as good. The expert biologist is usually a prolific inventor of new names (as he has practiced with the naming rather than the measuring member), and a number of branches of evolution are named ("Ency. Brit.," "Evolution"); but as the principles have been seen the reader will not be loaded with them here.

§146. a. We shall get a view of the principles of biological *sex*, *growth*, and *reproduction* by considering our stellar galaxy to be a live structure and noting definitely what those terms mean with respect to its mechanics. So I am going to describe the universe in terms of sex. That obviously takes the term quantitatively further than is conventional; that extention of the term applies only in this section. —— At the birth of the galaxy whirl (XII) it is comparatively fluid—i. e., all condensations are small (at least, smaller as a rule than later on). So it is *virtually young*—meaning that all "epigenetic" or "acquired" reactions or "factors" (i. e., all asymmetries coming, *when noticed*, from whirls in the galaxy whirl's environment—from "without"), and all "genetic" or "inherent" reactions (i. e., all asymmetries coming, *when noticed*, from its inner structures—from "within") can be readily (i. e., in comparatively small L and T) met or fairly balanced by secondary whirl formation. But as the galaxy whirl gets older, the condensations get heavier (the whirl becomes more a cluster; XII), and truistically an asymmetry has to accumulate more before it can budge some of those heavy condensations from their orbits to make the balancing secondary. Also, truistically such an accumulated reaction has a comparatively large effect upon the whole galaxy, and is more perceptible than a small, younger one.

b. If the galaxy whirl is considered a biologic cell, that implies that in its environment there are, besides other cells of the same order, natural structures smaller than it, those being less perceptibly organized structures—single molecules of food, etc.

c. The whirl is continually exhibiting secondary formation at its field difference surface (its cell skin)—either taking in food or rejecting waste, as secondary whirls or as some form of whirl combining. Obviously, the fact that an actual cell ever forms in a given environment truistically implies that at the time the general sum of the asymmetries is for the "food" to organize—that the cell grows. (There is also an "inner" cell life, due to secondary formation at the filament difference surface—at the skin of the cell nucleus, etc., —of which we have seen the principles in astronomical descriptions.) But at the same time the biological cell is giving off waste. So, unless the environing cells can eat or in some way remove the waste of the first cell, shortly the food supply is interfered with by waste, and the cell stops growing.

d. If the food supply is sufficient (if there is a tendency for the environment to maintain rather steadily an asymmetry in the direction of growth, instead of there being an environment that is practically balanced, as we tacitly assumed is the *perceptible* case—a fact, in the few thousands of years we have observed it—in our galaxy in XII), the cell keeps on growing, and getting older and hence unable (too unbalanced) to maintain such a steady growth. So at some stage of the growth an asymmetry accumulates sufficiently to cause the *whole* whirl to split—either by the mechanical equivalent of dumbbell splitting (§117) into two nearly equal parts (biologic "reproduction" by "fission"), or more usually by more or less perceptibly unequal splittings, just as with astronomical whirls—in which case the biological reproduction is known as gemmation or budding, sporulation, etc. To save the reader's attention I ignore the fine distinctions in such terms.

e. Truistically (§55, etc.), in no case can the splitting or reproduction be exactly equal—and in that fact of universal *quantitative inequality* of natural structures is exhibited all of sex, that same inequality or sex (*sex* is there used as a relationship word) including or resulting in the further tendency (1) of one cell to connect perceptibly with other cells to form multicellular individuals, (2) of such joined cells to become "specialized" organs, and (3) of such multicellular individuals to form societies. (Identically the same process of uniting is exhibited by ether cells, and by "higher" orders of structures, as we saw in Part Two; here we merely have new names for such structures.) —— The cell that 'grows too large,' so that it splits, has grown so old that it has a perceptible asymmetry, or inequality of halves, or sex. One unequal part is male and the other female—and it is arbitrary which is which, and I do not know which part is male with reference to distinctions in human sex. For sex is again our general problem of *direction* (§99b): i. e., fundamentally it is impossible that there be any essential difference in the sexes, as the difference is quantitative and reversible. Also, *any* part of the Many has a sex relative to any other part of the Many (not directly stateable, of course, when the parts are of different orders—as we saw was the case with temperature or any *potential*); for sex is simply asymmetry of equilibrium, and always with two natural structures there is some—some attraction and repulsion, in chemical or electrical terms. *Sex* is the fundamental human name for potential. (The term *tropism* is often used for such perceptible variations in biologic potentials, and asserted to be a "chemical" process, etc. Also, some biologists use as a general name for it, more especially with respect to the cell and its food and waste, the probably preferable term *osmotic pressure*, which is one form of our 'chemical affinity.') When no such asymmetry is *perceptible* we inaccurately say that the biologic potential is zero—that the body is asexual or neuter. And as mentioned, different order structures, such as a man and the galaxy, although not directly comparable in potential or sex, may be so compared by using the inverse square law. —— That is the total general theory of sex. It probably is not quite intelligible yet. And I can see no present need to figure out the comparative sex of chemical structures, etc.

f. It therefore is a truism that all growth (or waste) may be considered a chemical exhibition of sex. And all so-called asexual reproduction is by this rigorous theory sexual. Any secondary whirl formation is an exhibition of sex. But the *quantity* of such asymmetry is not enough to be ordinarily called sex until a biologic organism exhibits an attraction for another organism similar to the attraction of unlike electrical charges or magnet poles—with which it is identical in principle. —— That sex attraction is exhibited by all single cells if they are given enough time, thus:- The galaxy whirl, even if adjacent whirls clear out its cell waste and provide food, obviously keeps on condensing into a cluster or growing older (see par. m for a special exception—or §123), and its then relatively non-fluid or "ossified" internal condition stops its growth; and in the fairly steady conditions which promote such growth no asymmetries tend to rise that are sufficient to split the cell into new ones. And now we take it that the cell or galaxy is so much condensed that it is hard to split as a whole. But, at the same time this cell is thus reaching a sterile old age with respect to the sexual comparisons or reactions of its own parts, other cells in its environment truistically are developing a similar potential—but again truistically differing some in quantity. So by the time the food and waste in the neighborhood can no longer produce an *internal* sex effect on these galaxies considered as cells, resulting in "asexual" reproduction by direct fission, the potential of the food and waste no longer masks or balances the difference in potential of *two neighboring cells*, and the two combine, in the same way that two clusters or whirls do. That combining makes the new cell somewhat fluid, restores its youth, and starts a new cycle. So far as has been observed, all biologic cells do have such external "sex" unions, given a long enough time to age or to mature sexually.

g. Those phenomena obviously do not necessarily have

to proceed in the direct step by step fashion described. Just as two or more atoms need not 'wholly' interpenetrate each other and form some new elementary atom, but may form a more or less interpenetrating union (the fields and various condensations in them to some degree coalescing) to produce ions, solutions, molecules, crystals, colloids, etc., so two or more cells need not wholly interpenetrate each other in such a sexual union, but may have a partial union and thus build themselves up into a special organ. And organs may similarly build into an individual; the individuals into a perceptible family and a society; and the society may theoretically go on and build with others into a perceptible society of all the living beings in the universe. (There are practical difficulties in communicating with individuals in a galaxy so far off that even ordinary light will not travel to it; we shall be for a while doing practically quite well if we can have perceptible communication and hence social relationship, not largely destroyed by censors, with the people of Asia.) I. e., the dynamic unbalance between the environment of food and waste on the one hand and a few cells that are at nearly the same potential may be quantitatively just enough to cause a *partial* union of the cells. That can consistently be called a sex union; but conventionally that lesser degree of union is not called one. That union may be perceived as a direct growing together of "processes" of the skin (forming "connective tissue"); or the cells may join in other quantitative degrees—acquiring a single enveloping skin just as the solar field difference surface is a dynamic skin of the solar system. Such a union may be wholly of cells about alike, in which case there is an undifferentiated multicellular individual (more conventionally, it is called a colony, etc., of *uni*cellular ones). Of course no such collection can be perfectly undifferentiated —but some lower plants have no perceptible organs ("Ency. Brit.," 728-30). —— The "growth" of such "undifferentiated" individuals is obviously by internal sex processes, producing fission. But that produces no new individual; and obviously, as their cells grow old two multicellular individuals can not ordinarily unite sexually as can two cells, for the cell connections and outer skins interfere with such a process. But as the cells of an individual can not be *perfectly* undifferentiated or balanced, it follows that as the cells grow old and more "solid" the unbalance tends to accumulate at some *outer* location (by the principle of volcanoes; §122i), and the potential difference (sex differentiation) is there built up high enough to renew the growth of *some* of the cells and throw them off as a newly "born" or started individual—that internal sex process in its simple or "primitive" form being, I think, conventionally called asexual reproduction by terminal budding (sex is not conventionally understood well; so conventional names for the varying sorts of reproduction are vague). Truistically, that budding is a cumulated perceptible differentiation of the previously seemingly undifferentiated colony—an example of biologic hysteresis or lag.

h. Again, it is not necessary that that internal sex process or differentiation go to the limit of differentiation into two individuals. For obviously, certain cells in an organism may get perceptibly out of balance with their neighboring cells, and the unbalance may be slight enough to permit the two sets of cells to react with each other *as two organs*—the unbalance being thus 'sexually' compensated by the reaction of the two organs together in a conventionally recognized "division of labor"—a truism that is expressed by the formula, *Cells in one organ...*×*Cells in another organ...* (noting the dots or infinite regress). Truistically, the number of such organs can be increased as far as the stability of the environment (climate) permits (the "natural" determination of the number of organs follows the same principle of periodicity as the balancing of "increasing returns" with "decreasing returns" in economics [§170o], or the number of planets); always, in order that the *individual* may *exist*, two perceptible relationships must remain:- (1) there must be a circulation of small food and waste structures to and from all organs (as in the respiratory, digestive, blood and lymph circulation in a mammal; or railroad and other transportation in a perceptible society); and (2) a quicker circulation of 'field pressure' or "trigger energy" or electrical potential, to maintain for the individual a tolerable balancing reaction of organs (such more rapid balancing or unified control is exhibited by or as the nervous system in mammals, and by as yet unperceived circuits in plants, and by verbal, telegraphic, post, and other communications in a society). Those two are of course merely the two usual aspects of the same need; that one need can be summed:- 'coordinating (or generally balancing) structures or organs.' And recently it has been observed that there is a more or less perceptibly continuous or regressing series of coordinating structures of which those two sorts are verbally too sharply distinguished:- There are "chemical" processes of coordination (largely taking the place of a definite nervous system in lower organisms), consisting of internal secretions poured into the circulating streams of food and waste. The substances are named harmones and colyones; the first are said to have been observed to raise the energy potential of the organs they serve to keep balanced, and the second to lower it. *All* organs, as a truism of secondary formation, must give off secretions (they are what I have been calling 'waste'); so chemical coordination in some degree is universal—but obviously may be said to be rather haphazard coordination. The circulatory systems are quantitatively more systematic coordinations. And the nervous system is quantitatively even closer coordination, which works by direct field pressure rapidly (by electric currents). Obviously, the next general quantitative step would be a *perceptible* communication by *waves* given off by the nervous system or other organs; such would connect the parts of the given individual even more closely (rapidly), and also connect him with other individuals rapidly. And a slightly perceptible beginning of such a step in coordination is observable as telepathy, etc. That would be the last usually *named* quantitative step; the next general step would be gravity, in a sense or form that has no biological name now.

i. Thus we see how "organs" are specialized. It is merely a statement in biological terms of the infinite regress of structures. A number of such orders are actually perceptible in biology; inside the cell itself there are perceptible some orders or differentiation of groups of molecules, the cell nearly always having one perceptible grouping, the nucleus and the protoplasm (an internal female and a male part). That regress, or such mechanics, is proved by many observed facts. E. g., there are numbers of probably correct observations (Paul Portier) that often cells and the body fluids contain perceptibly living smaller individuals (symbiotes)—with individual "sex" life, etc. The regress of such 'individuals' truistically is infinite—their perceptibility is quantitative.

j. It is even more obvious that an individual with differentiated organs can not unite externally sexually with another individual—fully interpenetrate. For the connective tissue is in the way—furnishes bonds that too strongly preserve the individual's balance against such amphimixis. So the differentiated individual can achieve general balance of potential in only two practical ways:- (1) by internal sex processes—i. e., by feeding, etc.; and by reproducing itself "asexually" by re-growing a cut-off part, by budding, by spore formation or germ cell formation in general, or by other varieties of parthenogenesis: (2) by external sex processes—in some

way combining its germ cell with one of the opposite sex. The only process conventionally known as sexual, with respect to that differentiated individual, is the second. But it is now clear in detail that those various ways which the individual uses to keep himself in balance with the environment (or it is equally true stated vice versa:- those ways the environment uses to keep the individual fairly balanced—to "*preserve*" him) do not differ at all in kind (they all reduce, from the point of view of the individual, to *self-preservation*), but merely have different names for different quantitative degrees. The process in general is "living," and is usually arbitrarily divided into metabolism and reproduction, thus:- *Metabolism...* ×*Reproduction...*=*Vital process*, or *Life*.

k. Therefore, with a differentiated individual (unless it be externally—i. e., "artificially"—cut into pieces and kept in a clean nutritive environment, as Carrel has shown), the part of the process conventionally known as *Reproduction...* or sex does not rejuvenate the *whole* individual, but rejuvenates only a certain cell or certain cells. So truistically, as far as the greater quantitiative *part* of the individual is concerned, he (she, or it) can not ordinarily be made young by an external sex process (precisely as no physical potential can be raised for a *total* structure; §§140-1, etc.), and hence he for the most part grows old and in the ordinary sense dies. Therefore, *theoretically*, assuming surgical skill millions of times greater than now available, we could temporarily get the connective tissue sufficiently out of the way to allow all the cells of an individual to go through an external sex process (with the cells of perhaps another individual), and thus *the individual could be made substantially immortal.* Of course that is a stupendous job for some sorts of organisms.

l. It is thus clear why man grows old and dies. Briefly, it is because he grows so much connective tissue as a means of preserving a steady balance with the environment, that the tissue prevents a general rejuvenation when that is needed, and so *only a part of him* can begin the cycle over again (*except* when and as disorganized from being a man into his "chemical constituents": his atoms are individually reorganized then, but we do not call them the "man"). Or, we gain one advantage at the expense of another. —— And as a rather obvious fact, the truth of which is further implicitly shown in the next chapter, what we call our self or personality or consciousness consists of a series of mental phenomena in only one direction of time, so that if we were able to go through the complete external sex sort of immortality in a way perceptible to others, *we* would not see it as a perceptible continuity of our personality (nature has made one analogous step in such immortality in making butterflies, and as it didn't do them enough good, truistically they do not make another such step). In thus regaining our youth I judge we would forget our former self. That is a quantitative guess; self is a quantity as yet unmeasured, and my guess may be in a slight degree wrong. A child is a rejuvenated *part* of his parents; and that part does not *consciously* remember his 'aged self' that was his parents, or is not *consciously* immortal in that directly personal sense, although he is unconsciously thus immortal—inherits instincts (§158de).

m. There is another view of preventing growing old—that of internal sex processes, or *Metabolism...* . It is theoretically possible by keeping the *proper* food supply going to the cells and sweeping out the waste, to cause all pairs of adjacent cells to become sexually polarized and to coalesce, rejuvenating them enough to produce the subsequent needed fission. Such a process theoretically runs *Metabolism...* towards the infinity limit, it then becoming mostly inclusive of and identical with *Reproduction...* (we saw in §104, etc., that one factor ultimately includes the other; e. g., the change to butterflies in the last paragraph probably more properly belongs in the customary extent of the factor of this paragraph; the biological factors are also finally the same, or *the so-called fundamental "instincts" of self-preservation and reproduction are ultimately identical.* —— That method of continuous rejuvenation (if the *degree* of it is mild enough) gives a perceptible immortality in the sense that the personality could manage to change slowly enough to remember itself. But that method requires more quantitative knowledge than we have now. In order to achieve *absolute* immortality in that way, truistically we would have to have infinite quantitative knowledge, which is impossible for finite creatures. So we, as finite creatures, can not achieve absolute "self" or 'creature' immortality—the proposition being unescapably self-contradictory. *Considering ourselves as finally and really infinite* (which is the *exact* truth; §47) *we already have absolute immortality*—as is now obviously proved in a biological sense.

n. The practical way of applying the principles of age in order to live longer is truistically to make as good quantitative judgments as possible in keeping a balance of *Metabolism...* ×*Reproduction...* . Or, as *Reproduction...* directly affects but a few cells of man, it is better practice, after providing for normal sex life (which of course has much influence indirectly in producing the result we are to see), to make narrower standard universes of *Metabolism...*, such as *Food...* ×*Waste...*, and keep those reasonably balanced. Such practical balancing is excellently described in Fisher and Fiske's "How to Live." Metchnikoff's idea of prolonging life by keeping the intestines somewhat clear of poisoning bacteria is obviously one step in a general balance. —— An obvious practical fact, usually overlooked, is that a man may spend most of his time or energy in carefully maintaining his physical balance, leaving little to be otherwise useful to himself or others. Then he is rather worthless on the whole (except as an exaggerated professional example of "physical culture," a few of which are educative). Much Anglo-Saxon "overeating" is a proper instinctive *spending* of the body or "health" to get and *use* additional energy. In order to get the potential for beginning this book, for five years I deliberately ate quantities of sugar which I knew would end my life some years sooner (other things being equal); I figured that it was worth the spending of health, and possibly I have thereby acquired other means of regaining more years—and what are a few years in the darkness of ignorance and sloth worth anyway? —— In man, the organ upon which most strain or unbalance tends to come *directly*, assuming the others to be fairly normal, is ordinarily the nervous system. So if it is kept active and well nourished (balanced), the other organs will be kept in fair balance and some youth by it. If you grow a quantitatively new idea, truistically the nervous system, and in turn the whole body, is in some degree rejuvenated by it. But if the idea is radical, unbalanced, not "so," similarly you die some. I may mention that my health is fine, and getting better; that indicates that this book is generally sound.

o. As the various organs become more highly specialized truistically each of them tends to become more and more definitely polarized ('magnetically') with certain of the individual's cells, named germ cells, which are highly unbalanced so that they strongly tend to combine with other oppositely unbalanced germ cells in an external sex process (and in turn truistically incline the whole individual thus). Those germ cells sum up the polarity unbalances of the individual's other cells. So they are comparatively unstable ("variable"), and various perceptible degrees of "sex" are possible with them. I. e., those germ cells apparently always divide by gemmation before they are "mature"; and some germ cells give

several generations parthenogenetically and then the next generation requires sex amphimixis; and some germ cells can be fertilized by chemical structures of a "lower" order, as shown by J. Loeb. Obviously, sex, even in its usual meaning, is nothing exact and constant—a fact in agreement with our total argument. Also, it is a fact that many sorts of cells (e. g., some of man's blood cells) subdivide, and lead what is usually called a parasitic existence, with sometimes an external sex life. I. e., in a highly differentiated individual, sex processes are perceptibly duplicated in infinite regress (cf. symbiotes, par. i). And that shows further that a so-called individual or person is perceptibly by no means an exact or absolute individual. If we look closely at a man, from any point of view he is not an exact individual (cf. §47).

p. Some sorts of individuals (such as many plants) balance their various organs by producing germ cells of both sexes. But obviously, by the principle of asymmetry, each such individual tends to be more one sex than the other—to have a sum of unbalance other than exact zero. In agreement with that, it is observed that such double-sex individuals preferably cross-fertilize.

q. So, consistent with the last paragraph, an individual, as it becomes more differentiated, tends to become more perceptibly and definitely sexed—tends to have a chemical or electric polarity of its own, as a summed up potential of all its atoms. Consequently, that highly differentiated individual's germ cells in turn react on the rest of it and produce perceptibly specialized organs conventionally called sex organs—we saying that their function determines the sex, although it is true vice versa, sex being perceptibly 'circular,' like valid logic. So it definitely appears that perceptible "sex," being the summing up of the polarity of every atom in the body, is a quantitative condition, subject all the time to changes. I. e., a man may be more male one day than the next—a fact tacitly accepted by everybody, in respect to such marked variations as the age of puberty, etc.

r. It then is a further truism, that for a highly differentiated species like man, the fertilized ovum, which is the perceptible beginning of an individual, is theoretically of a certain polarity, and hence is definitely sexed. Recent observations show that ordinary sex is substantially fixed by fertilization (J. Loeb, "Organism as a Whole," VIII; for general proof that cells themselves often perceptibly show sex in all the variability here described as pertaining to the whole organism, see Loeb's book, or "Ency. Brit.," "Cytology"). But theoretically, if *proper* quantitative measures are taken, the sex of *any* organism can be changed at *any* time. And it is now obvious that the male organism is attracted, actually "forced," towards a female organism in the same way that gravity and electric charges work.

s. This section gives the mechanics of the so-called vital force (or forces) in enough detail to show how it works, and that it is identical with the force or relationship of any phenomenon. It has also implicitly but clearly appeared that all biologic processes are *mutual* (act according to the third law of motion)—being a balancing of forces from within and forces from without,—that answering ultimately the biological problem of §145e. That balancing obviously takes place in infinite regress in full agreement with *That*... × *This*... .

§147. a. Conventional biologists usually imply the questions answered in the last section by:- "the problems of heredity." Heredity is the general relationship, or more or less perceptible continuity or identity of successive generations. And as that conventional definition obviously involves the implied assertion of the One in the ideas "relationship" and "identity," and of the Many in the ideas that there is a perceptible change and "successive generations," and as the observable evidence is of interest to men and easily seen, then the problems of heredity obviously tend to involve biologists in an at least tacit discussion of the One and Many. And heredity actually has been the subject of debate for years. It is equivalent to the debate among physicists as to whether atoms are real or not.

b. The usual form of the biological question is whether acquired characteristics are inherited. The average man, automatically using the valid logic, has for ages naturally held that they are inherited—and by customary agreements as to the use of language, is of course right, as we shall see.

c. But the biologists for some years tended to hold in effect the idea that all life is derived from previous life (and that is a One truism—for an atom, etc., is necessarily alive if anything is); hence, they tacitly held (what is obviously another One truism) that *any cell has all characteristics*. I. e., the biologists, being scientists and constrained to split things into the Many in order to use *positive* language, vaguely but in effect held that there was *perceptible* an infinite regress of characteristics in any living cell: they thus tacitly used the formula, *Inherent characteristics*.....=*Life*. That formula asserts the truth of infinite pluralism, and is of course quite right (Part One). And by such language, truistically *all* characteristics *are* inherited, and logically there is no such thing as an acquired characteristic. Some of the best English biologists are now rather definite in their use of such a language, which form (cf. Reynolds's theory, §91) is not ordinary language. E. g., Bateson in effect says that a *new* characteristic becomes *perceptible* in an individual when some of the individual's other infinite characteristics become imperceptible and hence no longer mask or hide that "new" one. That is obviously a backwards, Nirvana sort of language (for in everyday language we would say that that "new" one was old, etc.). The same infinite pluralism may be seen to be implicitly used by J. Arthur Thompson, in his "Heredity" (especially in VII, to which the reader may refer for details (for a briefer statement of the debate in some detail, see "Ency. Brit.," "Heredity").

d. Therefore, *if* those biologists would say that they are talking infinite pluralism, which is formally opposite to ordinary language, then they would be quite right. But they would obviously mean the same as the everyday language conclusion that there are both inherent and acquired characteristics, and that both are inherited. Such everyday language of course takes it for granted that when we talk positively of characteristics we mean perceptible ones, so that the formula (indicating the infinite regress of characteristics or properties into imperceptibility) is:- *Acquired characteristics*... × *Inherited characteristics*...=*Life*. As a practical convenience it is better to stick to everyday language in biology —*unless* it be decided to change to infinite pluralism in all science. It was shown in the last section that every phenomenon can be expressed consistently in terms of sex. But to make such a mere quantitative change in language is most probably undesirable—it is a matter for the decision of the majority (§171k). To reverse language nearly wholly, in order to agree verbally with English biologists seems to me radical—but then I am more conservative than the majority. —— The English have taken on Weismann's theory of continuous germ plasm (see next par.), which in its primary state was a correct and needed assertion of scientific continuity in biologic terms, and consistently and correctly carried it out to a logical end. At first the British, following Darwin's and Lamarck's commonsense that acquired characters are inherited (which commonsense was of course exaggerated to a formal infinity by materialists in spite of Darwin's mass of data to the effect that such inheritance was slight in degree),

opposed that idea of Weismann's, and the beginning of the present British theory was soundly established by American biologists, led by Jordan and Brooks. After that valid infinite pluralism in biology was established by Americans, they naturally (i. e., with the practical commonsense which Americans substitute for the showy and less sound European erudition that often is nothing but ponderous piffle that awes the foolish) gradually changed to the more useful everyday language of *Acquired characteristics...*×*Inherited characteristics...* —and that sound and readily intelligible and useful form of biology is being expanded in America now by such first class men as Patten (who has unified the steps in the evolution of man), Ritter (who has been writing the argument of this book in terms of biology), Wilson, Kellogg, and Conklin.

e. And there are some biologists who are wrong—the materialists, led as is usual with materialists by a German, Weismann, who elaborated his originally valid idea of biological continuity into a detailed assertion that there is a finite and definite set of classes of entities which determine inherent character, namely:- idants, ids, determinants, and biophores ("Ency. Brit.," "Heredity")—which has much less meaning and logical soundness than the poetic assertion that little girls are made of sugar and spice and everything nice. Those materialistic biologists are sharp, exact, precise, rather insistent that there is nothing in life but what can be seen from *their* experiments, generally scornful of everything not falling within their finitely much narrowed purview. In fact, although Weismann discussed general principles specifically, he is by some claimed to have reversed his stand on the fundamental matter of acquired characteristics. In the article "Heredity" just cited it is stated that lately "Weismann has admitted the possibility of some direct modification of the germ-plasm in the body of the individual acting as its host." In short, he years ago vacillated about *principle*, and seems to be doing it again. That is a direct, rigorous proof of the unreliability of Weismann:- that he has perhaps twice shown that he is incapable of recognizing the difference between principle and measures or experiment—between qualitative and quantitative—between the One and the Many. —— The German chemist Ostwald showed the same fundamental incompetence (*total*, if we judge him *strictly* by his words—which of course is not practically possible), in the 1908 preface to his "Outlines of General Chemistry," in his remarks about accepting the "reality" of atoms, which reversed his previous views of the principles involved. As those men were perhaps typical pre-war Germans, having perhaps more intellectual integrity than the average German, those readily verifiable facts about them tend to show that the pre-war German was not able to distinguish 'measures' or expediency from principle, a part from the whole, a "scrap of paper" from an ultimate consistency of mind or "moral" obligation—that the pre-war German had become so materialistic that all of the general equation he could grasp was a a few unfinished *This*'s. Or, apparently his most extensive conception was a few *This*'s that summed into his former aristocratic *State*. And that is what an aristocrat or autocrat essentially is—a materialist, a provincial minded or weak minded person who considers himself and a few associates to be essentially the best, and the only people who need to be considered. So he naturally wants to be "boss," and pose in the lime-light. —— This paragraph is important in that it indicates a method of judging the worth of men, and implies the principles governing "changing one's mind." Fundamental principles are simple enough for a normal child to understand. So when a man fails to grasp *principles, and stick by them*, then truistically he is shallow and superficial and incompetent. There is but little excuse for an adult's ever being definitely wrong in principle and needing to "change his mind" in the matter. When an adult vacillates with regard to principle, especially unconsciously, he is of little worth. But *quantitative* matters or measures are always changing. So the reliable man sticks to his principles, but *always* is "changing his mind"—his *judgment*—to agree as well as he can with changing quantitative circumstances.

f. The usual technical way nowadays of naming the units of the Many in the infinite-pluralism equation *Inherent Characteristics.....=Life* is to say that each character is a unit Mendelian characteristic. Such a characteristic in analogous to an atom—a *real* atom in a universe of an infinity of them:- *Atoms.....=Universe.* So the briefest way to describe Mendelism is to say it is a biological atomic theory. But some biologists tend to be materialistic about the theory—holding in effect that there are a limited number of such characteristics, each a finite, constant, fixed unit that can be juggled around forever without change. However, much direct evidence has been accumulated (by Castle and other good observers) showing that there are no such sharp *finite* units.

g. A Mendelian character, in ordinary language, is a finite 'biologic atom' which passes without *much* change from generation to generation. Sometimes a unit characteristic is observed to appear that was not perceptible in previous generations—thus starting what is often considered a new species. Such an appearance is known as a mutation, or a "discontinuous" change, in distinction from a variation, a slight change or "continuous" step by step process from generation to generation. But clearly that distinction is merely a quantitative one. Obviously, by the principle of periodicity there must be organic structural parts ('biologic atoms') in such various L and T relations; as a truism of our use of L and T there can not be an infinity of organisms between two actually perceptibly different organisms, giving a *perfect* continuity of steps between. So truistically, neither a mutation nor a variation is perfectly continuous or discontinuous, but both are perceptible quantitative different steps in the infinite regress that applies to all structures. So we see from the direct point of view of heredity, that we can formulate a spectrum or a periodic table of 'elements' of the inheritances (biologic structures). And it is obvious from the last section that there is no absolute distinction between one generation and the next. So the table of biologic 'elements' of any generation is also in infinite regress in generations—which is quantitatively absolutely identical with all other phenomena, and again (cf. §144h) theoretically establishes a science of biology as definitely quantitative and exact as that of (say) electricity. There is no theoretical difficulty in making biology as "exact" as any science. But if biology were to use any such roughly approximate equations as pass for "exact" astronomy the *perceptible* inaccuracies would be ludicrous.

h. Thus it is rigorously shown that any atomic mechanics may be studied from biologic processes. But that huge mass of possible knowledge, and further details of heredity, must be omitted at this point. The general important practical conclusion about heredity is that *probably most of our traits are the results of a quantitative balancing for millions of years, and hence are mostly rather stably balanced* with themselves (internally) and with the environment. So unless we change that balance *very* considerably, we truistically usually can not change a trait much. Obviously, it is excessively poor quantitative judgment to fancy that if we cut off the tails of rats for a few generations, then they ought to begin to be born without tails; for evidently, to cut off their tails makes little difference in their lives. If we cut off the tails of a million generations, then the accumulation of little changes might make something perceptible begin to happen to their

tails. However, to make a perceptible change in their tails quickly something that will intensely and widely throw the rat out of balance must be done:- so if we cut off their heads a violent unbalance results, and there is obviously an absence of tails thereafter; in fact, there is an absence of the whole rat in future generations—the rat has promptly and definitely *acquired* a number of negative characteristics. That is not a usual point of view; but it indicates what is reasonably good judgment as to inheritance. In multicellular beings, truistically the general communication and transportation systems, the general coordinating organs (§146), serving to change as the environment does and keep a balance, are most easily variable. So it is a reasonable judgment that (say) man's nervous system may be fairly readily modified, and that such an acquired character may be transmitted in perceptible measure (but usually of course in much less degree than its acquired degree). That is in agreement with the practical judgment of all who believe that some "education" is desirable (for statement of the *Environment...* part of the continuing changes caused by education, see §166c). So it is a rigorous truism that human nature does change. The total facts of this book show that it can and does do nothing else but change. But a good bit of the change is probably cyclical, canceling in the long run. However, when the climate stays fairly steady, as it seems to have done for at least the past 9000 years (Osborn, "Men of the Old Stone Age"), there is a steady accumulation of nervous endurance and hence extended grasp, and quite probably of increased intensity—a very important change in human nature. —— In a One sense—i. e., in the sense that there is a universal perfect balance—human nature does not change: but in precisely the same sense it is infinite in its manifestations, and hence is also *always* absolutely new and different. So the sententious people who assert no change, even in a One sense assert but half the mystic truth—and sententious people are those who deal in such half truths. —— But in any *quantitative* sense, theoretically men change. And so far as I can judge the facts, men have better nervous systems or minds or spirits now than at any time in known history, in the usual sense of "*better*" (given in XVIII). So prospective parents may correctly conclude that their child can be improved both by direct inheritance of traits they have acquired, and indirectly by their giving the child better nurture or environment; and that it is probable, as a general average in a steady climate, that the child will be better. As a matter of fact, ordinary intelligent parents, guided automatically by the universe or commonsense (or, to use the old phrase:- by the grace of God), have held such an idea for centuries in spite of the fact that recently (and probably at various times in the past) it was in opposition to materialistic biologists, and in spite of the pessimistic folks with their half-truthful croak that "human nature never changes."

§148. a. In the sciences other than humanics, the asymmetry or the potential between any two structures (or between any two 'factors,' as *That...* and *This...*) may vary in any degree towards the limits 0 and ∞ (§80m), and no explicit comment or name is conventionally applied to the difference in potential; sometimes enough difference causes a new name to be applied *to the phenomenon*, but not directly (§83). But throughout humanics there is an important difference of terms:- *those differences* of potential are named, thus:- as soon as an unbalance goes quantitatively far enough the condition is given a name which is largely a relationship word, or explicitly implies a *quantitative ratio*, or *implies a measurement* (is in effect an ordinal *number*; §43b)—there being many such names. The general name of large unbalances in biology and psychology is *abnormality* or *disease* (in psychology, specifically a mental or nerve disease or insanity). And that part of humanics that treats explicitly of such unbalances is called *pathology*: practical or applied pathology is called *medicine*. In ethics such unbalances are called *evils*; in sociology, *crimes*, etc.; in economics they are called *usury*, *profiteering*, *greed*, etc.; in everyday life unbalances of less degree than those "abnormalities" are bad manners, queerness, tactlessness, etc. There are thousands of such words, direct or implicit. In general, our life from an *L* and *T* or practical, quantitative point of view is the preservation of a balance (we must preserve a certain balance to exist; §§114c, 149, etc.). So all humanic words tend strongly to imply at least, a judgment or guess as to the measures of all things with regard to their balancing effect on our lives. A whole branch of science, ethics (XVIII), is explicitly concerned with such judgments; and all *practical* sociology and economics is similar.

b. As a consequence all of humanics is so permeated with at least implications that such quantities have already been measured or judged that it is difficult to state any of humanics "impersonally" or "impartially" or "unprejudicedly," as the "exact" scientists would say. *But obviously such a persistent inclusion of quantitative judgments makes humanics actually more of an "exact" science than the conventional "exact" sciences.* For always humanics carries along a statement of at least rough measures, and tends thus to be somewhat reasonable or not quite silly; whereas conventional "exact" science perhaps half the time drops statement of the measures that Kelvin substantially says is the basis of science (§2c) and thus has a persistent tendency, repeatedly seen in Part Two, to run to 0 or ∞, which is religious expression—and is merely silly or radical when claimed to be scientific. E. g., when in §146 I started naming all processes 'sex,' I promptly derived a language which was far from intelligible and was much more vague than is everyday language, which by 'sex' means well known tacit quantitative measures; and when I showed in XIV that everything could be expressed as electricity, I did precisely the same thing, but it was not noticeable that such language became quantitatively indefinite. In "exact" sciences we may obviously drop definite statement of measures and experiments—and even talk of increase of entropy, which is positively silly,—and still *seem* to be conventional and to be reasonable in judgment, whereas we are actually being wildly radical. Truistic with those definite facts, scientists who blatantly claim they are "exact" are airing their hopes—practicing 'make-believe' (§155). Such blatant "exact" experimenters are often the worst radicals—depart worst from actual measures and usefulness.

c. In brief, all the humanics are forced by conventions of the ordinary man's speech to carry along continually some more or less explicit statement of judgment as to quantities. Humanics are thus *in actual practice* far more nearly exact, and demand far more knowledge of and direct reference to experimental facts, and in one word are far more *scientific*, than are the so-called exact sciences. So humanics theoretically are not only better mental training in science (they are too hard to be dumped first on an untrained mind), but are more directly useful, and serve as the best check I know of upon wild inaccuracy, and that irrational running to zero and infinity which we have seen so often occurs in the "hard-fact," "experimental" sciences (e. g., Steinmetz's silly socialism, and even more puerile excursions into general science). (I hold no brief for biologists, or other humanics expert; I am not one, and never expect to be one, but simply state the simple principles and a few glaring facts.) The practical objection to humanics is not that they are vague, but that they are so difficult that we are likely in them to

become quantitatively confused. To approach humanics with any considerable chance of remaining consistent, and fairly balanced quantitatively, we need to train some on the simple "exact" sciences taken correctly as inexact. —— A volume or more of rather obvious conclusions from the idea of this section is omitted here. *But* it is to be noted that these quantitative measures in humanics are *not* very systematic, and often are not what we would call conscious and hence definite. This paragraph is quite true, while at the same time it is true that definite, systematic measurements are badly needed in nearly every branch of humanics (experts in humanics have no grounds for acquiring that smug self-satisfaction from the fancied "perfection" of their science that attacks as a severe dry-rot many "exact" men).

d. It follows further that to understand any of the humanics, we must definitely know the general theory of what is quantitatively abnormal, and get some standards as to what degree of departure from the balance constitutes abnormality. The fact is that in no branch of humanics is there any very definitely agreed upon standard of what is normal. But there is a remarkably close tacit *average* agreement as to human measures, and if we know the general principles and are fairly average ourselves (i. e., not unbalanced or abnormal), we shall find ourselves using those measures before formal science can definitely make them. E. g., it has been found that in a fairly steady market the prices of foods were in much closer relative proportion to their actual nutritive worths than dieticians were able to figure until after many years' work; even yet it is likely that the market price may be more accurate in the long run than *formal* experiments.

§149. a. In this section we briefly consider biological abnormalities, and the applied science that deals with them:- *medicine*. A biological abnormality or disease is defined as "any departure from the normal [i. e., "common" or average] standard of structure or function [i. e., use] of a tissue or organ" ("Ency. Brit.," xx, 915). That implies that the normal, or "health," is an *exact* balance. That is not a useful, soundly scientific definition; as *every* thing is always asymmetrical relative to others, that definition asserts pessimistically that all organs, etc., are diseased. So if the encyclopedia gives the orthodox definition, it appears in a general way that the conventional theory of measures in humanics is confused over the One and Many. (We shall see that such is often actually the case; e. g., the usual ethical rule for conduct, do unto others as you would that they do unto you, is *quantitatively* wrong; §162). So we may at once make a consistent scientific general agreement, applying to the whole of humanics, that for the "average" individual (or organ, or any structure), from any point of view, there is a certain quantitative departure on one side of the *precise* average balance, and another (usually about the same in size) on the opposite side, which departures from an exact average are quite tolerable, pleasant, and normal (a more precise and definite picture of this is given in Fig. 163 for ethics, which may be substituted analogously for the present rough introductory statement in biological terms); and departures further than that are for the time being abnormal—or disease, or painful, or "wrong." Truistically with asymmetry or incommensurability, the normal quantities on each side, are, for each individual, different from other individuals', and are always changing for a given individual—what is one man's meat is another man's poison (*but* in a *very mild degree*, usually). —— This quantitative matter of abnormalities is the theory of harmonic periodicity; previously our attention was on the structures that were built up out of broken down ones, and now it is on the breaking and broken down ones.

b. Truistically the general cause (the "aetiology") of any disease (or other abnormality or "wrong") is a sufficient departure from the balance. (There really is no such unbalance *ultimately* or religiously, as we saw in §114c; a disease exists verbally, in formal L and T terms, when we are considering a finite part of the universe, such as an individual—which is what we saw in terms of logic in §25). —— The disease may be perceptible after a short time lag; and perceptibly cease after a similarly short lag, upon the cessation of the unbalance (in which latter case it is an "acute" one). But the time lag may be greater, so that the unbalance only slowly throws various structures out too far; the structural unbalance is then likely to lag, as a "chronic" disease, for a similar time after the removal of the "cause." —— Obviously, therefore, if we do not in experience learn what are the normal limits of our balance, and properly manoeuver to keep within them (be temperate), we shall have disease. It is a practical need that we learn such human quantities. And we get such knowledge by having a sort of sensation to which we give the general name *pain* when we exceed the limit. We may readily observe that there is no sharp distinction between a feeling of pain and one of pleasure; there is a vague 'neutral' zone between, agreeing with our difference surface and the total theory of *That*...×*This*... (cf. §163). If we do not feel (observe) sufficiently keenly, or interpret a sensation as being a pain when it comes of too much unbalance, or if there is considerable time lag of the sensation and we overlook its cause, then truistically we get out of a fairly pleasant balance without at the time definitely knowing it and correcting it, and sooner or later we die if the unbalance cumulates. So pain is the physical (or mental, if you prefer that word) price we pay for being stupid—if we are. And so far as I have observed we are all of us sufficiently obtuse mentally to get pained occasionally.

c. Clearly, all of our *perceptible* life is the consciousness of an unbalance or difference of potential (1) between the environment and ourselves, and subsequently, as a circular process, (2) between our own organs, and in turn (3) between them and the environment—and (4...) so on ad infinitum until our bodies wear out. If there were no such local unbalances we would perceive nothing—as has been shown repeatedly. Obviously, such perceptions of unbalances can be *continually* experienced without accumulating abnormally *only by a cyclic process*—by going first in one way and then the other, giving off and then taking in secondaries across difference surfaces of the body. —— A general example of that is the cycle or rhythm of feeding:- We eat, and a certain amount of food, having flavor near the average, is pleasant; but too much food, or food that is too much or too little flavored, is unpleasant or painful, and if too painful perceptibly kills (with slight time lag). Then after eating we do not eat for a while, using or "assimilating" that food, and get pleasantly hungry. If we go too long without food it becomes painful, and a cumulation of the unbalance in that direction also kills us. In precisely the same way any structure is changed in order ("killed") by too much unbalance.

d. All observed organisms tend to be active roughly as a whole for a while, and then be similarly quiet—so that there is a large or 'individual' rhythm of anabolic and katabolic processes. Numerous examples are so well known that they may be omitted. In the case of man that rhythm is in general an alternation of waking and sleeping; i. e., after we have been active for a while, accumulating a general excess of anabolic results, the coordinating nervous system, in some more or less yet unmeasured quantitative manner stops unifying or making perceptibly "conscious" the individual, and each organ more or less 'disconnects' from the others, and rests, and recuperates from the stock of food previously

accumulated. Obviously, during sleep we are more or less dead. But we can not be absolutely dead, for the unifying relationship of (say) gravity *always* persists between the ether cells that are our bodies or minds.

e. The important point to note now is that if we go through life keeping within the pleasant limits, sleeping at the right times to give a painless, rather unconscious recuperation from the pleasing anabolic activity which always *tends* to accumulate painful fatigue poisons (waste), then we can *as a general rule* be perceptibly happy, or comfortable, or cheerful—or truistically optimistic. But if we went along in that pleasant existence very long, obviously we would (due to the fact that our perceptions are poor) (1) fail to remember just what were our quantitative limits, and would (2) also fail to exercise our organs to the verge of those limits so that they would keep the habit of having such limits for pain. As a truism of both those reasons, we would either accidentally occasionally run over the limit into pain, or else would reduce our limits of tolerance so much that our nervous systems would have to make a painfully intense effort to stay inside them, and we would be "bored"—that boredom obviously meaning a painful effort and impatience at maintaining a delicacy of balance that is narrow (the result of too much coddling in this case). In both events we would suffer pain. In the case of boredom, it is sensible to choose to be pained in some way in order to restore a reasonable wideness of perception that likes an ordinary unbalance (thus avoiding being an "exquisite," or a mollycoddle or achieving an "artistic temperament"; cf. §159h, etc.). It sounds paradoxical; but it is merely a case of harmonic periodicity. An application of the same principle is furnished by this book:- I get tired of maintaining a careful precision of statement—making *That...* and *This...* react in a delicate balance. The normal reader is also tired by it: we are both bored by all precise, "exact," meticulous, "hard fact," "sure thing" discussion having such narrow limits of tolerance, even though I show that absolute accuracy is impossible. But that boring of myself and you shows directly that those who fancy that they want a life without pain, or exact science, are not aware of its nature. We do not want to play a "sure thing" life, or have a really exact science; we want to gamble more or less, depending on the limits of what we (and *especially* the others affected appreciably by it) can stand without much pain—and if we can't do that we become bored so much that the pain of being a mollycoddle or a similarly narrow Puritan is greater than the hurts of quantitative risks and mistakes (for rigorous theory of gambling, see footnote 163h; deliberate cumulative gambling is death). And what we thus actually want is hence proved to be what we can have: we can not have any hard facts, sure things, or exact science, for there are no such things. After your experience of being bored by the precision of this book—by its "austere mechanics"—you are truistically experimentally competent to judge just how much of a sure thing in any part of life you want, and can dodge falling into being a mollycoddle of either the luxurious type or the Puritanical mentally narrow and timid (i. e., precise) type. —— In brief, I have demonstrated by directly verifiable biological facts that there can be and must be if an enjoyable life is to be preserved long, *a temperance in being temperate*—an infinite quantitative regress in temperance. The present age perhaps is intemperate chiefly in demanding hard facts, and exact science and experiments. The German materialists are a sufficiently horrible warning example of such intemperance; but as it has not before been *proved* that such intemperance is possible, I had to prove it was by some intemperate precison as a sample (cf. §35).

f. Consequently, occasionally as individuals, because individually we are finite, we must accidentally (from *our* point of view) be pained; and occasionally to escape the worse pain of boredom we must deliberately (from *our* finite point of view) subject ourselves to pain. The fundamental error of the parasite is that it, she, or he is too stupid to act on the latter fact. We dislike the parasite because its actions imply a fear of pain—a fear of vigorous departure from the balance,—so that we judge it a coward. Clearly, the pre-war German docility, the acceptance of military "discipline" and of "paternalism," was one grade of parasitism, and implied some degree of shirking of life just as the poor workman shirks. And the resulting narrowing of perceptions led to or caused the customary autocratic egotisms of the "leaders" that the shirks were then afraid to and incompetent to hold to account. It is quite rigorously consistent and circular, you see. —— So from another point of view it is obvious that a general unbalance in our lives must accumulate (due to subjecting ourselves to pain, to "hard work," in order to maintain perceptions), so that finally we as individuals die. But as a general thing, if we are fairly intelligent, life is pleasant and free from pain. The man who suffers very much does so largely because he fails to use enough intelligence to avoid it—and not as a result of extrinsic bad luck, an unkind Providence, etc. It seems to be reasonable arithmetic to judge that, because we have a fairly wide tolerance for unbalances, whenever the L and T sum of pain in our lives reaches 25 per cent (with pleasure amounting to the other 75 per cent) we are automatically dead. So in a quantitative sense it is a reasonable guess that the actual amount of unhappiness, and-or warranted *quantitative* pessimism in people's lives is not likely ever to go as high as 25 per cent. Also, a *quantitative* amount of optimism equal to 100 per cent is never warranted. And as we by experience vaguely know those quantitative facts, we find a large amount of verbal pessimism to be as wrong (and because it tends to unbalance *us* by suggestion, to be as offensive to us), as is a large amount of optimism or asserted gladness. An attempted 100 per cent "glad game" is totally illogical and hence much more offensive than the bad guessing in a 50 per cent "grouch"; but Mrs. Porter asserts ("American Magazine," Nov., 1918: I have not read "Pollyanna"—I didn't think I needed it after a course of Christian Science and some years of the "wonderfully" glad people in advertisements) that "Pollyanna" herself sensibly tried merely to have any inaccuracy of estimate of pain fall in favor of optimism [obviously that is correct in principle], and did not try to be a 100 per cent *quantitative* optimist. As a general problem in *principle*, ignoring expression of quantities, the One is perfect, and so *in our everyday language* the "real" truth is that optimism is perfectly right, and pessimism totally incorrect. *Also*, because all of the Many (because *every* finite structure) in time ceases to exist as such, or "dies," and as death is a zero quantity customarily named "undesirable," then from a *general* Many (infinite pluralism) point of view, pessimism is totally correct. So if we talk infinite pluralism, by ordinary verbal agreement pessimism is correct. And relationship or God the Holy Ghost words may validly imply either pessimism or optimism, depending on the customary way of considering the "direction" that they imply or name.

g. Truistically, therefore, the panacea for all diseases is to restore the balance. And such a panacea is obviously a special quantitative problem for each case, and often *practically* impossible for the general reason that we can not perceive *in the time available* just what and how much the unbalances are, or-and just what to do to restore balance. In time we may acquire much of that quantitative knowledge; but always it will be impossible practically to keep a *finite*

individual alive eternally (§146m). A German, Ehrlich, formulated a theory of a reputed real panacea which was to be in effect a chemical substance (i. e., had a molecule not so elaborate in structure as a "living" organism), that would act as does a general sort of internal secretion—traveling in the body and restoring each cell to a balance, whatever its diseased unbalance. As is usual with the ideas of materialists, that theory of a panacea exhibits the failure of its author to grasp the nature of the One; for a real panacea is a One, and anything that approaches being a panacea approaches being infinite—a simple truism of which Ehrlich seemed to be ignorant:- For such a chemical panacea would obviously have to be infinitely varied to meet and adjust the infinite possible unbalances; and Ehrlich personally could not have made a chemical of that sort, and no *individual* man could have swallowed one molecule of it if Ehrlich had. Further, he apparently overlooked the time factor: for in order to cure a disease such a panacea truistically would have to work faster than the nervous system does, and in the ordinary sense of the word, a "chemical" will not do so. —— As a matter of obvious fact, in a strictly rigorous sense there is already a real panacea in existence, available for use by everyone, and actually used by everyone:- the universe. *There is no* FINITE *cure-all for any unbalance*—biological, sociological, psychological, etc.,—*and truistically can not be.* As stated, the restoration is a special quantitative problem for each case, and like all quantitative problems can not be *accurately* solved, though practically a fairly good solution is usually readily obtainable.

h. But we can work out some general rules for the restoration of unbalances, which may be quantitatively adjusted to particular cases. Physicians already know and apply these rules, and continually try to get closer adjustments of measures. So I shall be brief in outlining them, although the total universe could be described in terms of these rules for curing disease. —— We need to agree first, as a truism of conventional meanings of words, that a disease is "cured" when the organs chiefly involved are restored to within normal limits. Truistically, it is never possible to restore the various structures to exactly the same condition that existed before the disease. And also, the diseased structures, their host, the physician, his medicines or tools, and all the rest of the environment are mutually interacting in effecting the cure, sometimes one and sometimes another of those factors being quantitatively more important. No one of the factors is ever totally absent, and no one of them *alone* effects a cure. The physician and his tools may be perceptibly missing in a given cure, they blending with all the other unperceived environment; but when nature thus "alone" does the work, there is usually a comfortable, healing knowledge that a physician is available—which makes him an actual factor.

i. Medically, a disease can be "functional" or "organic." When it is functional, it is meant that there is some unbalance or structural defect ("lesion") inside cells or other structures, which lesion is so small that it is not perceptible structurally, but is shown only by the poor functioning or working of the structures. When it is organic, the lesion is perceptible or "gross," so that *both* the structure or organ and the functioning are perceptibly abnormal. Truistically, ultimately the function and the organ are identical, and the distinction of functional and organic is a quantitative one—and in practice is continually being further shown to be arbitrary and never distinct. —— It is also possible to divide all diseases into (1) those caused by poisons (unbalanced secretions) given off from the insides of cells or organs, and (2) those caused by the introduction from without of 'poisons' (which consist of any largely unbalanceable foreign objects, such as improper food or other chemicals or objects, including live objects such as microbes and bacteria):- *Unbalances by foreign poisons...* $\times$ *Unbalances by internal poisons...* $=$ *Disease.* There are obviously an infinity of such classifications possible; the doctors find it convenient to use a number of such, but as the principle of them is obvious I may omit them here—thus omitting volumes of quantitative experimental detail. Such abnormal details, by their nature of being *very* asymmetrical, would truistically give us the *most easily perceptible* facts about biology. —— Such pathological details are offensive to a normally balanced person—that meaning that he judges them to be an unbalance he himself wishes to keep away from. As everything is connected, such a "personal" point of view can not ever be *totally* avoided, in spite of the erroneous, dualistic standard of complete "impersonality" recommended by some materialists. So obviously, a doctor who can succeed in so thoroughly considering any disease as a "case" that he has no perceptible personal attitude towards it, thereby shows that he has lowered or narrowed his ability to observe (and diagnose and treat) in a quantitative degree perhaps dangerous to the patient—has unduly killed his brain. But the non-medical man should recognize that the physician must in some measure avoid feeling too much personal sympathy in order to work; and in the effort to do that, many doctors acquire an outward habit of pretending to do so which helps them to ignore their sympathy enough, but which make-believe by no means indicates their actual perceptions or state of mind (§155). I mention such a familiar condition with respect to doctors because the same outward pretense of indifference and impersonality is often displayed in a normal degree by other men for their work, and it is well to interpret it correctly. It is especially so with scientists, who apparently coolly discuss all sorts of abnormalities: the keen observer, by understanding the principles (§155), can readily see under the make-believe. Generally speaking, the person who actually is too impersonal or calloused, pretends, in a half-conscious effort to balance his defect, to be very sympathetic with many things and becomes gushing, "gay," "sloppy"—sentimental or mildly hysterical (e. g., the professional patter of the average trained nurse). But of course the few great doctors have the strength not to need those pretences—can be steadily natural and unaffectedly poised, leaving their total strength unhampered in seeing more than the ordinary man can—e. g., Weir Mitchell, Goldthwait, Cabot, the Mayos. That applies to other men, of course; e. g., as Dewey says in his Introduction, I indulge in make-believe about the 'trick' with words; I do it about another subject, too; hence I have not the requisite strength to write this book properly. (I may mention that the last ten lines were not in the version of the book Dr. Dewey saw.) —— It thus is beginning to appear in a few details how very widely in our lives the humanic quantitative estimates extend. We have already seen that classic logic is incompetent in them: we now see that the classical logic views as to the need of impersonality in science are erroneous—in a way directly offensive to normal people. So it begins to appear just why and how "logic"—classic logic—got its bad name among men. —— Also, the reader begins to see evidence that in humanics things are not always what they superficially appear to be, and why only a knowledge of principles, coupled with conscious experience in estimating the measures of men, gives definite understanding in humanics. Such understanding shows that our judgments of human motives are usually very *inaccurate* (§148c).

j. As I must omit the classifications and descriptions of biological unbalances in detail, we may briefly note some of the principles of cancer, as being a sort of practical general summary of diseases. In cancer some cells get out of balance

(out of the control of the rest of the body), and start what is substantially an "individual" life of their own (and perhaps they exhibit 'external' sex, although no definite observation of that exists so far as I know). Obviously, there are two general ways in which cancer can start:- the body cells and organs other than the cancer cells—other than the cells which later get out of control and are cancer—get relatively weak or subdivided (become lacking in strong unity of balance, just as galaxies grow old) in innumerable ways, so that certain otherwise normally strong cells have too high a potential relative to those other cells and hence start out as uncontrolled cancer cells; or (2) the body cells in general stay in normal strength of balance, or perhaps have even stronger balance or unity than usual, and some undue external stimulus or "irritation" acts on the cells that become cancer to jar them into such a relatively high potential that they start off individually. In the first case the cancer cells stay normal and the body control or potential drops; in the second the body stays at normal potential and the cancer potential goes above normal—both producing the same *relative* effect. (The directly quantitatively opposite disease to cancer is gangrene or abscesses, where some cells get so relatively weak that they die. All diseases, including cancer, *in part* exhibit some dying of cells—agreeing with the principles of cycles and of valid logic.) —— So again as mere truisms, the remoter causes of cancer are very numerous, and cancer is theoretically an infinite series of particular diseases in which there is locally an over-high relative potential that in effect is a reversal of the multicellular organism back to unicellular life (analogous to the breaking up of too highly condensed star clusters), or is a 'biological socialism' (§175d)—although some cancers tend to differentiate into multicellular organs, that may be called a "higher" series or order of cancer, and is a less radical biologic socialism. So all the orthodox theories of the cause of cancer are probably right, the varying theories applying to the varying sorts of cancer (see "Ency. Brit.," Index, s. v. "Cancer"; Bainbridge, "The Cancer Problem," Sec. IV). And various differences in cancer potential are observed:- some cancers are quickly brought under control by the rest of the body (as in "benign tumors"), and are often absorbed (e. g., warts on a child's hands), the potential not being able to remain above that of the rest of the body. Other cancer cells act as if they had great excess of potential, grow rapidly, and can not be checked in any way yet found that does not also kill the host. —— Cancer when once started reacts unbalancedly in various ways with the body, and if not checked finally kills it in some of those ways. We may look upon the unbalance from any of the quantitative points of view already mentioned:- (1) It uses an undue amount of food, tending to starve the rest of the body. (2) It throws some of its cell waste into the general circulation, and that is sometimes perceptibly damaging. Those are the inner and outer points of view with respect to cells. —— Considering the body as made up of organs, there are two similar points of view:- (1) The cancer cells take up space needed by other organs and thus tend to block or choke or squeeze them out of existence and grow in their space. (2) The other organs similarly block off the cancer cells, and tend to kill them. (A secondary result of that is that often the cells in the interior of a tumor are blocked off [the tumor, being largely undifferentiated, may itself help do that blocking off], and die and decompose, more or less poisoning the host.) —— All diseases truistically go through similar reversible processes—which are obviously the secondary whirl formations of Part Two. Cancer is a disease in which the differences of potential are easily seen. In diseases due to the introduction of foreign live organisms there may usually be greater differences of potential; the processes go faster, and 'overrunning' (acquired "immunity"), etc., make them harder to see clearly.

k. From that summary of the general processes in a disease the general methods of treatment are obvious—being truistic. All diseases—all so-called wrongs and evils—are local asymmetries which we judge we want in better local balance. So we move around some of the things outside the L and T that apply to the given local asymmetry, in order to get a "smoother" (i. e., wider space and time) distribution of the asymmetry, which thus becomes *locally* narrow—or cured, as it falls within the limits of toleration (par. a). So truistically the most important thing to note about the cure of any disease or evil is that it is a local process, and that the universe as a whole is all right and needs neither any general or total cure (reformation), nor any local reform so violent or fanatical that it over-cures and makes an unbalance in the opposite direction as bad as the one reformed. (To cure a man of indigestion, and charge him all he owns for doing it, so that he starves, doesn't help him much—a simple fact which second-rate "specialists" are too dense to see.) The words *cure* and *reform* conventionally have taken on considerable implication that an essential or One meaning is intended —that everything or the whole [usually a standard universe] is wrong. The kindest thing which can with fair truthfulness be said of such an implication is that the quantities are grossly exaggerated. Such radical cures or reforms are hence so bad that they have cast a suspicion of incompetence upon those who claim to cure anything. In actual practice the ostentatious reformer or healer is usually as wrong as the local unbalance he fancies universal—but in the opposite way.

l. As a typical application in practice of that general theory of reform or cure, we may consider medical cures more specifically. A certain lot of cells are out of balance, and (1) the balance must, as a truism, be restored either (A) by stimulating them in some way to a higher potential or to a lower potential as may be necessary, or (B) by acting vice versa on the *other* cells of the organism—or (C) we can combine those two. And (2) as a further truism (of L and T, as this is a quantitative problem), either of those variations of potential may be produced either (A) by a direct and intense action *on the cells* whose potential is to be varied, or else (B) by a more or less indirect and extensive action *upon the cells' environment* (or a combination of the two, of course), so that the environment in turn acts on the cells, varying their potential. (That obviously makes the two arbitrary methods ultimately identical.) And finally (3) either of those two must be either fast or slow, compared with whatever standard velocity we choose. —— Those three truisms are of course trite and obvious; but as they constitute complete quantitative statement of the methods of restoring all unbalances it is well to have an explicit statement of them—as the obvious is usually overlooked in emergencies (i. e., in unbalances).

m. So we may in general treat a disease by simply putting the patient into a different environment; if the unbalances are slight and obscure the chances are that "nature" will cure it—even though that 'change of environment' is so slight as to consist of merely "absent" mental treatment, if the patient is made quite cognizant of such treatment, by (say) such a perceptibly concrete variation of the environment as paying for it. If he has to work a bit vigorously to pay for a "change of air," the change will probably cure him—while just the reverse change will cure another with about the same unbalance. In such cases of change of scene the method is slow, and the environment is changed in unknown degree, and acts indirectly. In a more severe disease the patient may die before that method has time to work; and

when a patient dies it is commonsense finite judgment to hold that there was no cure. —— All that obviously indicates whatever there is of good in *laissez faire* methods: in case of nearly complete quantitative ignorance about an evil, the only sensible thing to do is to let it mostly alone while finding out something definite (it is of course impossible to let it absolutely alone), and to supply the slight 'change in environment' by explicitly recognizing that the universe or "Providence" is treating it. Truistically, a little way out on the infinite regress *all* treatments become laissez faire (it is the practical end of no exact science). But the other side of that verbal half-truth is that we are always tinkering with all unbalances and that those tinkerings also have infinite regresses so that there is from that point of view no such thing as laissez faire. Therefore, any rational laissez faire is that applied to an evil so slight as scarcely to be painful, or is that which is used when we do not know with reasonable certainty what to do and have not had time to observe the details.

n. The opposite extreme of cure, both in shortness of *T* and in direct application of the action to the diseased cells (i. e., *L* is also 'short'), is surgery, where the diseased cells are forthwith removed as completely as possible, or else poisonous secretions or foreign substances are removed, or misplaced cells replaced. Obviously, in such a cure the most nearly accurate quantitative knowledge that can be obtained is required, as well as skill and art in directly applying it in the shortest possible time. *Perfect* surgery truistically consists of opening all the diseased cells and repairing them atom by atom or electron by electron, etc., restoring a normal balance, and doing it so fast and so directly that no secondary damage is done to the organs. Clearly, we are not likely to get very close to that speed and delicacy soon; surgery in practice must leave some unbalances in the organism (there are usually some new ones also, made by the surgery) to be cured afterwards—largely by laissez faire. —— When such remaining unbalances are about as bad and-or as hard to cure as the original ones, truistically the surgery is practically useless. And when the surgery kills the patient with any perceptible directness, by ordinary language it is truistically a failure, and I will not bore the intelligent reader discussing contrary quibbles. The surgeon who speaks of a successful operation, the patient dying, is a materialist.

o. Between the extremes of laissez faire and surgery are all varieties of cures. The most commonsense cure is of course to use the various methods in combination:- Suppose a man stuck a fairly large splinter into his hand, that introduced enough poisonous germs to infect the wound. We at first naturally use direct methods, cleaning out the wound and disinfecting it as intensely as possible without causing appreciable damage to healthy tissue. If the infection is very hard to kill otherwise (which I do not think is the case nowadays), we deliberately cut out some perhaps healthy tissue so as to be sure to reduce the danger of infection, and then cure the deliberately made unbalance later. By those intense, direct methods we get as much cell balance as can be quickly obtained, and as can be achieved with some certainty that we were getting at the right cells. In applying those direct methods we protect the patient's nervous system by anaesthetics, both locally and generally, as may be necessary to prevent any accumulation of marked unbalances due to pain upsetting the nervous system and indirectly other organs (and later the patient can recover from that anaesthetic poisoning *slowly* and hence with tolerable discomfort). Then we begin the indirect, usually slower methods. We introduce (usually via the digestive tract) various chemicals into the circulation of blood and lymph which are to exercise a balancing effect on the abnormal conditions still existing about the wound and secondarily elsewhere. A trifle of definite knowledge of such drugging, with respect to killing foreign organisms, exists, and is constantly being added to; but very little is definitely known of the effects of other sorts of chemicals: and not much is known of the secondary effects (unwitting unbalancings) of the infection-killing drugs. So that indirect method of drugging is theoretically useful, but practically in its infancy—a fact well recognized by leading physicians, though they are often doubtful whether it is wise to admit it to the average man, and thus give him a chance to jump to unwarranted conclusions and despairing states of mind. Yet I quite agree with Cabot that the patient ought to be told the truth: for the proof that such a principle is correct, see throughout XVIII; also, there is obviously no more reason why a man should become mentally a mollycoddle and be "protected" from truth, than that he should be a mollycoddle protected from vigorous work. —— Then the next sort of indirect treatment is to feed the patient properly, so that the normal parts of him will have their potential raised somewhat if possible, as a means of healing the wound. Similarly, we put him in an agreeable, restful environment—and do not go out of our way to tell him unpleasant truths just then. But possibly the most effective indirect treatment available (and it may include as a part of it those just mentioned) is to get the man to think that he is going to get well quickly and want to. Then the strongest coordinating factor of his whole organism, the nervous system, is actively engaged in having the whole body give out proper secretions, etc., to restore the unbalance in the hand. There is nothing mysterious about that: it is what the nervous system is for—why it differentiated into a definite organ. But because for so long the dualists have taught that mind and matter are essentially different, the average man often has a vague notion that "thinking" he will get well will not do any good without "material" drugs. So there is no objection to helping his "thinking" with foods, drugs, and environment; those "material" things are part of his thinking anyway, and if he is correctly told that they themselves will help some, his thinking is likely to be normal. The direct treatment thus supplements the indirect treatment; we apply *all* the quantitative knowledge we have, in the proper times and places, and get a cumulation of good effects. And when we run into ignorance, we stop and leave the rest to nature.

p. But clearly the most sensible way to treat a wound is to avoid getting it—the man ought, as a general rule, to have kept his hand away from splinters,—such indirect treatment, given by keeping the nervous system alert, being more efficacious and comfortable than any other, up to a certain point. In brief, a quantitative knowledge of the probable situations of life should be obtained, and unbalances treated before they accumulate to a very painful degree—that being the principle of *preventive medicine*. A reasonably intelligent man can usually manage to avoid any serious injury; and by keeping in good balance by means of food, work, etc., is not likely to be painfully affected by swallowing or otherwise absorbing disease germs and other foreign matter from the unavoidable ordinary environment. If he finds it advisable to expose himself to injury and infection, he can, by the same indirect methods, anticipate and ameliorate effects by creating such resistance. Considerable knowledge has already been gained by medical science as to how to create a chemical antagonism to infection. —— And preventive medicine, like other sorts of treatment, can not be perfect. The chief objection to it is that it itself will cause unbalances if taken too seriously and overdone. Also, chemical indirect methods of preventing infection (e. g., typhoid vaccination) cause perceptible diseases that may on occasion be as undesirable as

those they prevent. The use of preventive medicine by an inhabitant of Cuba against frost-bite is usually not sensible.

q. Perhaps the most exaggerated idea advanced in medical science in recent years is the mental healing one—and of those who propagate that idea the Christian Scientists seem to be the most emphatic. Those mental healers are obviously to a large *quantitative* extent right: clearly, if we can be cheerful, and confident that we are strong enough to "down" any disease, we shall most likely prevent our getting any disease—barring accidents not worth while trying to foresee and avoid. It does help a certain more or less hysterical type of person to avoid disease *temporarily* (it truistically in the long run harms), to come flat out with the absurdly exaggerated assertion that there are no perceptible unbalances—no disease and no evil. The hysterical person has an aristocratic type of brain, in which from some cause (usually from generations of parasitism and docility: often from intense shocks, etc.) the perceptions are much narrowed and in that actual unbalance with the environment there is a tendency to consider everything more or less wrong. So if such a brain, in a violent effort to cure itself, asserts emphatically enough that there is *no* unbalance, the direct, temporary sum of the two unbalances is a balance—health—so far as the hysteric can see. So from his point of view (but usually a hysteric is a woman—about twenty to one), there is not any disease, and he is rather immune. And when he has a "mortal error" that he has got a disease (in our everyday language his "mortal error" is a concrete fact), he stimulates (frequently with a "healer's" help) his brain to assert even more intensely that he is all right. It is truistically possible for a man to grow on a new leg in place of a lost one if he can "think" a new leg with *enough* intensity. But as as a matter of commonsense in quantitative matters, he is not likely to, and would be sensible not to waste time trying. Mrs. Eddy's very elaborate "glad game" obviously has occasional usefulness medically. —— Incidentally, Mrs. Eddy's "Science and Health" is a striking example of a mystic book. It is not science; science is pluralistic expression (X), and her book is surprisingly mostly the opposite—being an almost continual jingle of One words, which judged by everyday pluralistic language, is largely nonsense. But she keeps at the ineffable One so long that the book actually does give a sort of religious grasp of things if the reader can avoid objecting to its nonsensicality from the scientific point of view (so it appeals religously to over-sophisticated people who have learned mostly what isn't so; Index, "Rebirth"). There are numbers of such mystics in the Middle Ages: the Catholic church usually approved of those classic ones. I rather think her book is useful when understood for what it is. If she thinks *science* is a fashionable word it is rather a good thing that she misuses it some, as it is bad for science for it to be fashionable. And perhaps unquestionably Mrs. Eddy cured herself by her unusually persistent ineffabilities. What she had was severe hysteria: ample proof of that will be obvious to the fairly close observer who reads a panegyric of her:- Sibyl Wilbur's "The Life of Mary Baker Eddy": cf. §155.

r. It is therefore obvious that the quantitatively best way to restore an unbalance is to use a practical, balanced combination of the reasonably easy available ways. Leading physicians nowadays definitely take the unified view of man given by this chapter, and apply the unified methods outlined in this section. The practical idea of the Mayos was to get a unified competent diagnosis. Goldthwait has improved that idea by showing definitely that the human being is a unit, and then collecting a coterie of experts to treat those who chiefly have something wrong with their skeletons. Goldthwait thus finds a way, so far as formal organization can do it, of getting the advantages of specialization without its worst disadvantages (the disadvantages, for obvious reasons, almost unavoidably crop out in *large* organizations). —— In sociological analogies, we have seen that a "nature cure" is laissez faire. Obviously, the surgery cure is a revolution, going as far as a reign of terror. Autocracies try the Christian Science cure of jingo patriotism, paternalism, and saber rattling, thus giving mental healing in an exaggerated way by specious promises and scaring off devils, until some social abscess blows up; and then there is usually a resort to social surgery. Existing democracies more or less blunderingly try more moderate methods, analogous to the cure for the splinter wound, and usually manage to muddle along some way—which is better than blowing up. A conscious democracy with a fair amount of intelligence obviously would use preventive medicine, and get along healthily; for preventive medicine is merely having keen enough nervous systems to observe a *slight* departure from a balance, starting correcting it at once if it tends to accumulate. —— Obviously, this section indicates the general method of correcting all difficulties or wrongs. An intelligent child can understand the method, and grasp the fact that it is truistically rigorous. But the application of the method requires careful quantitative judgment as to just what and where the unbalance is (actual diagnosis, rather than mere complaining or calamity howling), and as to the available means of curing it with the least disturbances of other balances. That application truistically involves an infinite regress of measures, is absolutely insoluble with accuracy, and for acceptable practical solution needs strong, vigorous, keen observers, who see not only the unifying relations in their specialty, but their extension.

CHAPTER XVII. *Psychology.*

§150. a. Psychology is the description of the universe (or usually in practice, a standard universe), taken or made from the reverse point of view, or in the opposite direction, from that in which we start with ordinary or "objective" *That*'s and *This*'s. Or, in the book up to this point we take *That*'s and *This*'s as '*positive*' or given, and make an equation *That*...×*This*...=*Meaning*, and consider that the *Meaning* is our result or conclusion, or what we are "after"; but in psychology we *start* with *Meaning*, usually calling it the mind (or some synonymous name), and going in the reverse way, split it into arbitrary parts. Thus, we have an equation from both points of view:- *That*...×*This*...=*Meaning*=*Feelings*...×*Intellect*... . And for those psychological terms *Feelings*... and *Intellect*... we may substitute numerous otherwise "psychologically" named factors, which are simply new names for *That*'s and *This*'s.

b. Clearly, that definition of psychology is circular. And the total of all descriptions of the universe, including psychology, is thus explicitly circular—as *Feelings*...×*Intellect*... (or some equivalent pair of factors) is identical with the various *That*...×*This*...'s but is reached by starting from where they "end." So the definition of psychology, and the fact that there *is* psychology, are consistent with the solution of the One and Many, and with valid logic—is final general crucial proof of the validity of everyday logic.

c. Classic logic, with its dualisms, goes in only one direction and hence can not give a consistent definition of psychology *as a science*. For proof of that, see the attempts of Ward ("Ency. Brit.," "Psychol."—xxii, 548) to give one, and his admitted failure to make such dualism work. (He was a very able British psychologist and philosopher; his

"Pluralistic Philosophy" and "Realm of Ends" are in effect identical with the argument of this book, but formally not.) —— Ward in the place cited finally defines psychology as the "science of individual experience." If we take "individual" to mean any organized structure, then obviously "individual experience" is equivalent to *Meaning*; and the science of *Meaning* obviously is to "start" from it and split it into parts—into *That*'s and *This*'s—and state their relationships. And that truistically implies that conventionally our experience, or mind, or soul, or whatever it is preferred to call it, is perceptibly a *continuous* thing, or is "really" a *uni*verse—implies that we are persons, or are organized. When we come to examine our consciousness minutely, we sometimes seem to note breaks; and that has confused the matter. I imply the solution of that as we proceed.

d. That much of this section gives a consistent statement of psychology in the whole of knowledge, from a conventional point of view that ignores theory of measurements. A more rigorous description or definition of psychology (that implies the solution of its conventional difficulties, and makes it an "exact" science in the sense that it is as directly measurable as is, say, electricity) is:- (1) psychology goes in one direction, using arbitrary T or time to assert such a convention or convenience, while (2) the objective sciences go in the opposite direction, so that the *two together* cancel the "directions" and cancel *L and T* (i. e., cancel all quantities as being arbitrary), and give us the real continuous universe or *Meaning*. Or, to put that briefly, psychology is dynamic and the objective sciences are static, and *only* the combination of the two "sorts" of sciences gives a really complete or consistent knowledge (§80, IX)—or a consistent epistemology, as the philosophers name it. Or, to put it into still more intelligible detail:- Precisely speaking, the so-called objective or material sciences do *not* exhibit a relationship known as time. Obviously, we can not experiment, in a test tube say, in the "past" or in the "future" (§85d)—all our concrete, objective experiments consist of a comparison of *space* locations (identities) *in the present*. And as the "present" is a zero time-duration (is the *limit* between the past and the future), it follows that *precisely speaking there can be no such thing as a strictly objective or concrete science*: all our so-called concrete science is obviously multiplied by that zero (that zero time or T), and simply does not exist *alone* (i. e., as really or absolutely "concrete"), and truistically can not. In short, objective or material science (the science of "matter" that is sometimes asserted to be different, distinct, dualistic from "mind") is absolutely static in form and impossible. And on the other hand, again speaking precisely, *in our observation* of that concrete space or L—in all our "experimenting" with L in the "present"—we really do not perceive L, but perceive a relationship that we call a time interval—a T which is not zero, but an L which is zero. Or, speaking precisely, subjectively or mentally we do not consider things of thought as occupying space, but consider them as a series of time intervals, which is the "opposite" of space. Or, *subjectively*, the One is *formally* infinite time, and space is zero: *objectively*, vice versa the One is formally zero time, and space infinite: and only both together gives formally the *complete* expression of the truth (§147h), that expression obviously containing the formal inevitable contradiction of the One and Many. Therefore, there is in the science of psychology (the science 'opposite' material science) always a zero L, and hence such a *distinct* science can not exist.

e. The sum of the matter is that *in all of science which has any consistent existence we combine subjective and objective*, material and spiritual, concrete and ideal, static and dynamic (IX), and get an absolutely unified science, in which it is possible to make consistent but arbitrary *L and T* measures, and which is therefore arbitrarily pluralistic—that Many summing into a One. Thus, psychology is inseparably combined with so-called concrete science. And it is irrational to pretend (as do the materialists) that they are separable.

f. The precise equation for all knowledge is therefore:- *Objective parts implying L...*$\times$*Subjective parts implying T...*=*Universe*, in which T is $1/L$, so that we have the truism:- $L.../L...=1$, or *Universe*. We can analyze that equation in more detail:- We have *That...*$\times$*This...*=*Meaning*, and *Meaning*=*Feelings...*$\times$*Intellect...* or =*Feelings...*$\times$*Consciousness...*. In those equations (cf. Part One) *That...*$\times$*This...* is, explicitly, M's that are static; so truistically, *That...*$\times$*This...*=ML.... And *Feelings...*$\times$*Intellect...* is, explicitly, M's that are dynamic; so $M/T...$=*Feelings...*$\times$*Intellect...*. The solution of the One and Many requires that we combine the two, in which case, by §36, we have a series of truisms. —— So psychology comes in circularly, and can not be dispensed with as a part of any "exact" science. "Half" of the measuring, or "scientific" (§39e), member of our general equation—i. e., the term T—is psychological; and that member M(*varying with*)L^2T^{-2} thus implies an absolute, universal, circular, ineradicable identity of mind and matter. That is true with such glaring obviousness that I have been able to write this book up to the present point by tacitly taking it for granted. The total theory of measurement—of what is strictly science—is now explicit, and we see that there absolutely can not be any science not inseparably connected with "persons." There is nothing strange or novel about that: it is merely the obvious fact that science is made by men. —— The substance of pars. d-f is repeated, in a more conventional and intelligible form, in §158 on memory.

g. It is thus rigorously proved that mind and matter are identical—are not "parallel" in the sense of (1) mutual interaction (except of course the *immediate* implication of such is identity), or of (2) "occasionalism," or (3) pre-established harmony (see Index, "Teleology," for disproof of this third dualism), or (4) the "monism" of Spinoza which had mind and matter parallel attributes of One Substance ("Ency. Brit.," xxii, 600-1). In epistemology (i. e., in the most general solution of the One and Many) we must have (as a necessary truism of language; §§33-8) primarily at least two points of view which may 'logically interact,' and so we take this contradiction:- (1) we take 'things' (matter) one by one (arbitrarily calling that "separation":- space or L); (2) then oppositely we take "consciousness" or mind as continuous (arbitrarily calling that continuity in taking things:- time or T). That fundamental reaction or "contradiction" of static (one by one "things") and dynamic ("*taking*" those things) is truistically a prerequisite of any positive language. If we do not want to talk, then obviously there is never any need for any distinction between mind and matter. But if we do use language, then all complete statements must truistically contain the formal contradiction between mind and matter; i. e., all sound "scientific" statement must contain *both* concrete science and psychology—both L and T. So any valid science may be said to be *either* concrete *or* spiritual (psychological), *depending entirely upon* the arbitrary quantitative consideration of whether L or T respectively is more emphasized (hence man's "spirit" or soul is essentially the same as the mental activity of any animal, but differs quantitatively in the degree in which he uses T—which difference often is not enough to speak of). —— In the foregoing parts of this book I have conventionally emphasized L, as I was talking of conventional "material" sciences. In fact, so conventional is it thus to emphasize L, I often had to assert explicitly that there was a T included (cf. IX). If I were to go back

and emphasize T, more or less ignoring L, the descriptions would become psychology. In that case various names other than the "physical" ones used would be more conventional. That extensive psychology will not be given, but the use of such psychological names will be indicated in this chapter.

§151. a. There is thus no essential difference between psychology and concrete science. The quantitative difference is that psychology emphasizes T. There are two chief aspects of that quantitative difference. One is that psychology is so emphatic about T that in its conventional texts the problem of the One and Many is so nearly explicit that the texts seem much like "philosophy." The second is that psychology is always implying by its names a *measured* judgment—normal or abnormal quantities. We noticed that in §148, and I shall not again take it up explicitly.

b. As psychology starts from *Meaning*, or the universe considered as mind, the tacit emphasis is obviously on the fact that there is a continuity. In order to talk about a continuity, it must be split or "analyzed" (a real continuity is as such absolutely ineffable). And psychological splittings were so perceptibly not real splittings that always there was a disturbing knowledge in the psychological writer's mind that he was trying to assert two opposite things at once. At first, say in Descartes's time (or even more in that of Aquinas), before there was much clear thought on the subject, the mind was made sharply dualistic with matter (though the link, God, was then manufactured to repair the error), and the mind was broken into similar sharp dualisms known as "faculties"—such as the faculty of memory, the faculty of will, of feeling, attention, and so on as far as the ingenuity of the psychologists could invent. Such faculties were held to be constant, exact 'mental atoms.' But it is now unfashionable to hold that there are any such things—there too obviously is no sharp line or distinction between the arbitrary parts—so that even materialist German thinkers like Muensterberg, although they in effect use such 'mental atoms,' shy away from the name *faculty*. So now, more than ever, the psychological writer of much sincerity and competence is constantly engaged in a rather perceptible struggle with the One and the Many. And that struggle is painful to himself and often to the reader. There is obvious in Ward's article "Psychology" (a treatise of nearly 100,000 words, "Ency. Brit.," xxii) a constant rejection of explicit dualism, resulting in a painful uncertainty as to how the logic must go. The result is that nearly every psychological term is usually run by good thinkers like Ward (who have not advanced as far as our first class American psychologists like Dewey) into all three Trinity forms. Hence the confusion as to the conventional meaning of such words is dire—for one Trinity meaning is used about as often as another, and in the orthodox absence of explicit solution of the One and Many no logical distinction is clearly pointed out. —— As we know the solution of the One and Many, that conventional difficulty will no longer bother us by making most psychological writings vague and unintelligible—except that it will take us about a generation to get used to that solution, and to learn to apply it with easy skill. This book will look, to those of of a few generations hence, as unnecessary and clumsy as the old arguments that there are antipodes look to us.

§152. a. Psychology usually discusses *individual* experience—takes a man as being the universe, usually correctly as a standard universe. But obviously, we can let the single man unbrokenly include the total universe, and the mental sum of him in that aspect is (1) "social psychology." If we take him bounded by his skin, then there is a psychology of single although related men, or (2) "individual psychology." The principles of the two are obviously identical; the differences are quantitative, and due to the fact that the means of communication existing between members of a society are not so good as a rule as communication by the nervous system of one man. No quantitative distinctions between individual psychology and social psychology have been definitely agreed upon; I shall indicate the principles of both in this chapter, and give a few applied details of social psychology under its usual name *sociology* in XVIII, XIX.

b. In concrete science we split the universe into parts on the criterion of their having principal difference surfaces at V_1—which splitting could never make any part exact. In precisely the same way the entities of psychology, the mental parts, are tacitly divided and named by that criterion as arbitrary quantities. It has been found by observation that changes in the nervous system produce directly corresponding change in consciousness, and that such changes do so more directly and intensely than do changes in other organs. Even more directly, it is observed that changes in consciousness are accompanied by electric currents in the appropriate parts of the nervous system—truistically indicating organized field structure (XIV). So by the whole of valid logic and the description of the universe up to this point, it follows that the nervous system is *in general* identical with the mind or soul or consciousness. And as perceptible consciousness is observably accompanied by, and identical with, electric currents in appropriate parts, and as such currents are based on V_1 (XIV), it follows that quantitatively perceptible consciousness or soul is the result of such energy transfers to such conscious parts of the nervous system as suffice to cause their principal difference surfaces to acquire a velocity of V_1. That is obviously directly proved by the readily verifiable fact that if any "stimulus"—any transfer of energy to or from the nervous system—gets proportionally weak it will fail to give a perception; and if too intense, it will also fail (§156).

c. Those same quantitative conclusions are identical with biological facts:- The nervous system is composed of cells called neurons. Each neuron has at least one main process or thread-like extension of itself that may sometimes be several feet long, called the axon; and usually has small processes named dendrites. The axon and dendrites in turn usually divide into still smaller processes called fibers, and some of those fibers unite the cell with other neurons, and others may unite it with other sorts of cells in the body (by means of at least seven recognizedly different small organs that are "nerve endings," not counting at least two sorts of nerve endings in the retina, etc.); and so far as can be observed there is no discontinuity in those unions ("Ency. Brit.," xix, 401). So obviously the nervous system is a continuous coordinating organ, joining the body structurally perceptibly into an 'individual' (i. e., "continuous") organism. No other general structure of the same order or size as the whole body does thus coordinate it; the various circulations in the body coordinate it by means of their small "chemical" structures. —— And if there is such a thing as consciousness or mind in the universe, it must by our solution of the One and Many (it *must*, as a truism, *if* the universe is not chaos) be identical with the whole universe, and a part of it must be identical with some structural part of the universe. Consequently, as there must verbally be "consciousness" (or some equivalent name for the T in the general equation), it directly follows from the facts in the first part of this paragraph that biologically the quantitative or perceptible *consciousness* of the whole body must be *identical with the nervous system* structure. Such was seen in the last paragraph to be the observable fact. So this and that paragraph circularly and rigorously prove the general argument of this book, and explicitly demonstrate the verbal

machine or equation:- *Nervous system or cells...*×*Perceptible consciousness...*=*Consciousness, or Soul, or Mind.*

d. Therefore the customary meaning of *personal* consciousness (not necessarily *self*-consciousness) is obviously a quantitative meaning, given by the equation:- *Environment, including parts of the nervous system not perceptibly working...*× *Perceptibly working parts of the nervous system, or personal consciousness...*=*Consciousness* (*in general, or One consciousness*), *or Soul, Mind, etc.* That obviously rigorous equation (which may logically be either for the whole universe or for a standard universe, according as we interpret the extent of *Environment*, implies the solution of all psychological problems. Most such conventional problems are matters of definition—of observation of the language agreements used, to see to which Trinity part a term used belongs: thus, I have used the term 'consciousness' in both members of that equation, as it is obvious that conventional psychology and everyday talk do use that word about equally in the two logically contradictory senses (we also use it as a relationship word—against which additional and worst puzzle the mathematical symbols protect us; §80e-g). In order to be precise, I used the adjective *personal* to indicate the Many usage. But psychology and everyday usage give the term *soul* mostly a One meaning; so it is fashionable in psychology either to avoid the word (because as a One word it obviously is not a scientific or Many word), or else practically to deny that man has a soul. In everyday life it is getting to be bad taste to mention the soul—for that psychological reason, and also for the commonsense reason that we wish to avoid casual talk of something we are uncertain of. But evidently, as soon as we make the logical distinctions in the equation we know the nature of *soul*, and there is no embarrassment in using it—although as "soul" has been used with such gross irrationality in the past (especially in the theological phrase "immortal soul," meaning a personal immortal soul) the word may retain a taint of stupidity, and perhaps may better be avoided.

e. Volumes of detailed psychological solutions explicitly implied by the equation of the last paragraph must be omitted. The reader is amply able to expand into the details that interest him the few general suggestions needed here. The most important solution implied by that equation is that there is no such thing as personal immortality—for the most excellent reason that no fixed, constant, *distinct*, exact, "real" thing or person, or a personal consciousness, or a personal or Many soul exists or can exist. As a glaring truism, if a certain thing can not exist it can not be immortal; a prerequisite for immortality is existence. A person, or personal consciousness, or a personal soul, is a continually changing thing, as we shall see in more and more detail as we proceed, and as is obviously a fact from the slightest observation of our own consciousness:- e. g., our personal soul changes so much that quantitatively it totally ceases to be perceptible every time we go to sleep; and hence it never is perceptibly "immortal" for so long as a few days. —— *But obviously*, as our nervous system (and-or mind), *exactly* speaking, includes or is the total universe, truistically in a real or One sense we are immortal. I. e., time simply does not apply to us, ultimately, so that *right now* this *instant*, we have all the time there is—which we may equally logically say is infinite time or zero time. In that One sense you are an exact, fixed person—for you are, with absolute organic connection in infinite regress, the total universe or God, and as such immortal if we wish to say so (§47). We take up the moral aspects of immortality in §167h.

f. Because personality is a *quantitative* thing it is also not correct to say that it absolutely ceases to be—absolutely dies. Death (§146lm) is itself a quantitative thing and not absolute. So it is quite possible that there may be in some *quantitative* degree (probably a slight one) sometimes a perceptible amount of personality that survives what the doctors call death (but probably for only a short time). I. e., at medical death the person's nervous system may still in the cortex, for a while hold a physical organization or physiological unity sufficient in degree to give off psychic waves, still organized as being the dead "person," that might constitute a telepathic message to a "living" person. It may be possible that those waves could affect a wireless coherer or some such machine as Edison is reported making (which would be more reliable than persons). That is all theoretically possible; the phenomenon is merely a quantitative one, and in many cases the cortex shows no evidence of change shortly after death. It is even possible that such telepathic messages have been received: judging from the triviality of those reported by various people, and their grossly mutually contradictory nature, if any are genuine some such quantitatively defective, moribund "personalities" might have sent them. —— *But that does not imply personal immortality*: it proves the opposite, merely showing that personality is quantitative and changing when by a "person" we mean a finite one. It may be an experimental fact that some messages from the "dead" were "received" after the sending cortexes were organically disintegrated. If such happens, it is as a first approximation quantitative proof of a time lag in the receiver's brain. On the few occasions I have perhaps got telepathic messages from the living there was a time lag; apparently a message was stored up until my brain was about half asleep before it could get attention. But regardless of those quantitative possibilities, the truistic disproof of personal immortality is rigorous. Those possibilities obviously imply others, omitted here. —— We saw (§144j) that in biological terms there is no finite *real* personality; so there can not be a real personal immortality. And as direct experimental proof of the principle that there is no personal immortality, when I was dead (§144j) I was totally unconscious of my personality in the conventional sense. I know another man who was dead once and his experience as to having no personality is the same as mine.

§153. a. In orthodox psychology the nervous system or consciousness in general is considered to extend out in a vague way, and join on in some unstated way to the objective things which are "perceived"—in short, orthodoxly the environment is joined to us thus by the nervous system. So there is a well known word, with many synonyms, for that really-joined-on *Environment...* (including parts of the nervous system not *perceptibly* working):- *feelings*; with synonyms such as emotions, associations, sensations, subconsciousness, the unconscious, or even consciousness. (There are many such words that in principle are synonymous; but all of them, including the ones mentioned, imply somewhat different quantitative splittings of the universe—though there is some disagreement about those implied judgments.) Also, there is a well known word, *intellect*, for the *perceptibly* working parts of the nervous system, or for the *directly* personal consciousness. And the term *intellect* also has many synonyms (varying somewhat quantitatively):- thoughts, ideas, mind (in the sense of personal mind), sensations, perceptions, apperceptions, reflection, the conscious, consciousness, understanding, the reason, judgment, brains, sense, commonsense, etc. Therefore, we have for our explicitly general psychological equation in §152d, the more commonplace one:- *Emotions...*×*Intellect...*=*Consciousness, or Mind.* But there are commonplace words for that [One] *Consciousness* which are more precise. The word *will* (the psychological or mental *will*) is almost always used to name the climax

or summing-up of any mental action, and is obviously usually identical with that One *Consciousness*. Ordinary synonyms for *will* are behavior, experience, mental life, conduct, purpose, volition;—again there can be a quantitative difference in even those One words; that difference implies a quantitative comparison of extent of various *standard* universes used —an important logical point. So we may write the general psychological equation (omitting the measuring member, which is the same as in concrete science), in commonplace terms, as:- *Emotions...*×*Intellect...*=*Will.*

b. We may substitute synonyms, and get various illuminating equations:- *Subconscious...*×*The Conscious...*=*Intuitions...*×*Perceptions...*=*Behavior; Associations or Memory...* ×*Reflection or Apperceptions...*=*Mental life;* or, *Intuitions...*× *Sensations...*=*Experience, or Self;* or, *Intuition or fringes of consciousness...*×*Self...*=*Will.* Clearly, we can take any of the numerous psychological terms and by substituting them in that equation assign to them a well-defined, rigorously logical meaning. And we see that some words (e. g., *consciousness*) may conventionally be put in any place in the equation about equally well; e. g., above I shifted *self* from the standard universe meaning to the intensive factor, in which latter place it is obviously identical with James's extensive description of the personal self or personality in his chapter on the consciousness of self ("Psychology," X). A number of those terms conventionally are usually relationship words, and would most appropriately serve to replace the × (cf. §168b); such words are *association* and *reflection*, and often *intuition.* —— Hence, it is obvious that only a definite knowledge of the solution of the One and Many can determine just what a common psychological term does mean in a given case; for we continually shift the Trinity form of those terms. E. g., when we have a faint desire to emphasize the importance (i. e., quantity) of intellect, we pair it as *Intuitions...*×*Intellect...*, which rather implies that feelings too are intellect or faint intuitive thought. And when we get specially weary of the erudite fanatics and eulogists of the intellectual life who assert or imply that the intellect is the "real" part of life, we use some such correct formula as *Intuitions, or Instincts, or Feelings...*×*Sensations...*, which leaves out any explicit mention of intellect—although obviously it is replaced by a synonym (i. e., the dots assert a connected or *organic* infinite regress; so *Sensations...* means the pleonastic phrase 'organized or "classified" sensations' —which is truistically identical with the usual meaning of *intellect*, or with the necessary meaniug of "reason," if *reason* is to have any consistent meaning).

c. In the equation *Emotions...*×*Intellect...*=*Will*, it is obvious, as a truism of definition and by direct observation, that *Emotions...* finally (if we consider the whole universe) is the extensive factor that refers to all the parts of the universe and their workings which are not positively (we might say name-ably) perceptible to us as *Intellect....* So obviously, in numerousness of details included in a given state of mind, *Emotions...* greatly exceeds *Intellect....* That is the same as saying that the greater part of our behavior or mental lives rests upon or *is* emotions or intuitions or feelings in the sense that the more numerous details are emotions—and such numerousness is what we usually mean when we say "greater" or "higher." It is probably the correct quantitative fact:- that *usually* in behavior practically the vast majority of the details which we say are "consciously" involved are so vague and indefinite in consciousness that we call them emotions, so that the only definitely perceptible mental detail in ordinary behavior is consciousness that those numerous emotions exist. Such mental life, in which the intensive *Intellect...* almost vanishes, is called instinctive or habitual or intuitive or reflex action and may symbolically be represented thus:- *Feelings.....*×*Intellect..*=*Will.* Evidently, if consciousness or *Intellect..* disappears (as it may from one point of view be said to do in reflex action), then, from a psychological point of view, *provided* we retain our usual language agreements, the behavior has *quantitatively* changed, so that the individual *as such* is not concerned perceptibly (is not conscious), but the *organ* (or organs) of a "lower" order, which produced the reflex, is conscious. And that is *a passing from one order of structure to another*, so that, in precisely the same way that temperatures of different orders of structuces are not directly comparable, here the same intensive factor (now called intellect) can not be directly compared— i. e., a quantity of consciousness *perceptible* to an organ is not directly perceptible to the whole organism (a principle—that of periodicity—obviously truistic in those familiar terms).

d. So in "purely reflex" action, a different order of 'individual' (an organ, or part of the usual "individual") logically has a perceptible amount of consciousness, or *Intellect...* . That amount is not *directly* perceptible to the "individual"; e. g., we have no "intellectual" consciousness or control of our heart, but still we do have a degree of cognizance and control of it (I can deliberately vary my heart action by running), which we may say is a dot of *Intellect...* (so rigorously that factor never becomes zero), but which we usually say is some part of *Emotions...* (and when the naming or structural-relation thus changes or 'reverses' we have to introduce the inverse square law to preserve language agreements). That is obviously precisely the same as saying that the structures of a certain given order inside an atom have temperatures which are not directly perceptible to us, or are not at all temperatures *as such* in the usual sense to us—but which temperatures *are* ordinarily definitely existent to us when translated by the space law (inverse-square, to 'expand' the 'order'), and which temperatures can never become absolutely 0 or ∞ (because in that case the order of structure changes, and we become directly congnizant of them— just as we directly perceive our heart as soon as it departs only a little towards 0 or ∞). So we see that we can shift a 'dot' from one psychological factor to its mate—change what for want of a better name I shall call the numerousness of a factor;—that being a truism of the fact that they are arbitrary anyway. But, if we wish to retain our ordinary language or logic, we can not run either to 0 or ∞. (That is the psychological form of the proof that entropy can not and does not increase to infinity.) And all of that is precisely the same as saying that the two factors are irrational if taken separately; and that neither ever has any exactness. In concrete science all that is a little difficult to observe directly in some cases, as we are not very familiar with "material" facts; but in psychology it is glaringly evident.

e. The foregoing describes from only one of the two well known points of view the tendency of the two factors to vary in numerousness. Many men, on occasions when they notice the existence of perceptible sensations (the existence of *Intellect...*) of course promptly perceive a number of dots, and tend to deny and ignore the vague emotions. Evidence of that is shown in the proverbial assertion that man is the "reasoning" animal, implying that he relies solely on the numerousness of *Intellect...*, instead of being in fact mostly affected by *Emotions...* (cf. §150g). On the other hand it is conventionally implied that other animals have no such perceptible sensations or *Intellect...* or reason, but are guided by emotions—instincts. Truistically animals have some quantity of perceptible *Intellect...* and reason (animals have no "reason" in the sense of classic logic; neither has man; §25). Probably animals have it in much less degree—a quantitative

problem. If man has reason, then truistically animals, atoms, etc., also have it, in different degree—though like temperature, the "reason" of different orders of structures is not directly comparable. But when men start thus exaggerating the numerousness of the parts that are perceptibly included in *Intellect...*, they are likely to forget the more numerous parts in *Emotions...*, which in extent constitute the most of God or the universe and which equally with the over-vaunted reason guide us and support us. Those who thus illogically prune and preen themselves on their "reason" exhibit small measure of reason, and are popularly named variously:- intellectuals, erudite persons, the sophisticated, highbrows, know-it-alls—and *scholar* shows such a tendency to imply intemperate intellectuality that perhaps it is safer not to acquire that title.

f. We can see more of those two opposite tendencies to exaggerate either emotions or intellect by considering what the theologians call a *rebirth* or getting salvation or being saved, and the psychologists call a religious experience. There are many names for the phenomenon. —— Under certain circumstances we may get a large and intense flow of energy through apparently the most of our nervous system (most probably actually through some large part), which we designate by various names. E. g., we may see what we consider a beautiful picture, or scene, or action; or we may observe in ourselves or others some good, heroic, or otherwise remarkable and appropriate, suitable deed or quality; or we may observe the general fitness of things, the apparent perfect "purpose" of the universe or God, or the remarkably consistent characters of such men as Christ and Lincoln; and whatever it is that thus serves to make it more or less *perceptible* to us that the whole universe is absolutely consistent and fitted together as a real whole or organism or person, serves as a sort of trigger to release in greater or less degree energy from many nerve cells, and we have a greater or less flood of nervous energy which gives us such an unusual sense of well-being that we call it by a variety of names serving to mark it off from our more routine experiences:- ecstacy, rapture, inspiration, frenzy, transport, ineffable joy or felicity or peace, being one with God, mystical union with God or Christ or the saints, rebirth, intoxication (both "spiritual," and with alcohol and other drugs, as we shall see), orgy, orgasm, aura (as of an epileptic or hysterical fit)—and when it is definitely abnormal or pathological in degree it is named an epileptic, hysterical, or other sort of nervous explosion, convulsion, or fit; and mania. In the mildest mentally perceptible degree that flood of energy is humor [or when in the reverse 'direction,' but with analogous principles, is pathos], and results in a laugh—or in less degree, in a smile. So the reader has had a religious experience: even dogs smile. Possibly the reader has not had a rebirth that verges on the edge of the pathological, as do most of those described in James's "Varieties of Religious Experience," and as do those the theologians seem to require—but such more or less pathological ones are unnecessary, and a bit dangerous (§162, etc.). But as will appear (especially in §162), the reader, if fairly normal, has had ample religious experience to understand of his own observation all such experience—religious experience is as common as eating meals, although the somewhat pathological varieties fortunately are not common: the theologians have merely grossly overrated the rarity and pricelessness of their wares, as does the usual patent medicine advertiser. I have had religious experiences myself that verged on the pathological; and instead of making capital of them, as has usually been done in the past by those with such experiences (in that they or their disciples substantially claim that they saw or talked with God, or were otherwise tremendously favored), and implying that others ought to have similar experiences in order to have the "real thing," I shall prove in a way that you can verify that (unless you need to know by personal experience what you are talking about in order to write a book like this) they are fine things to avoid (§§162-3).

g. When we have a religious experience, frequently its chief characteristic is the vividness, or perceptibility, of the 'parts' of it—just as perceiving a joke consists of seeing intensely the point, that being a mild rebirth. That stimulation of our nervous system thus frequently causes a large number of the dots of *Emotions...* to surge into vivid perceptibility and hence to become a part of *Intellect.....*, and we seem to perceive the total universe—to see all of God, or actually to perceive all the dots in the infinite regress. E. g., the devil took Christ onto a high mountain and showed him all the kingdoms and their glories (Matt. 4); quite possibly Christ did have some such perceptible view of the infinite regress, which he could most intelligibly express in his day in that way—and quite likely he thus in effect condemned the violent rebirths recommended by the theologians by attributing that one to the "devil": instead of saying of them, Oh joy....., he said, Oh hell..... . As a matter of formal logic, we can perceive that total infinite regress at any time, so that we can with logical consistency write the *explicitly* infinite pluralistic truism:- *Intellect.....=Universe.* Then logically intellect becomes the total of everything; but so does emotion, or any other Many thing we care to name, and we have the trouble of learning a new form of language.

h. On the other hand we are accustomed to calling certain vague perceptions emotions or feelings. So ordinarily, instead of changing our names for those, when in a rebirth they become vividly perceptible, by nominally shifting some of them over into *Intellect...*, we merely say that the factor (or the sort of experience named by the factor) *Emotions...* has vastly increased. So there is truistically a tendency in such cases to consider the equation the infinitely pluralistic one, *Emotions.....=Universe.* —— Perhaps most people who have had a marked religious experience tend thus to consider it emotional, and unconsciously to exaggerate the view into an assertion that religion is wholly emotional. Of course if wholly so they merely change to a new language (cf. last par.). If we assume that Christ did have the religious experience mentioned in the last paragraph, we may note that his reaction to it was to tell the "devil" to get hence, which is obviously a refusal to change from the usual agreement to consider the One real, to either an intellectual or an emotional infinite pluralism. It can be noted that Christ, with extraordinary consistency considering the general inconsistency and ignorance of his time, adhered to the reality of the One. Such consistency is so remarkable in such circumstances that it not only reasonably well demonstrates the extraordinary consistency and hence fair approach to perfection of his own character (so that his reporters were forced by the sheer weight of it to make a roughly correct report), but *it also makes it probable that Christ mostly initiated*, or at least served to crystallize, *the general establishment of our present language agreements.* That is the greatest work any man can do for the race, *provided* the agreements are the best possible. And it has been shown throughout the book that ours are the most *economical* (for the next step, more suitable for improved minds, see footnote 100c). For the ethics of economy of time, see §165. Here, we have a definite, specific proof of Christ's greatness—an improvement on intuitive guesses.

i. Thus we see in vividly verifiable detail how mental facts are so 'fluid,' so inseparably connected, that a careless exaggeration of them led to the centuries-long warfare of science and theology, of reason and authority. *Very* roughly

speaking, science tended to assert that the truth was, *Intellect.....=Meaning*; and theology, that it was *Emotions.....=Meaning*. If we consider such to be roughly the historical fact, then obviously both were fanatics, and partly wrong if they claimed to be using everyday language (§49j-l).

j. We have seen that in a condition of fair mental balance the parts of *Emotions...* are more numerous but lack in vividness or intensity, whereas those of *Intellect...* are few in number but intense. So considering the whole nervous system as a structure, some few cells (experiment shows that they are apparently always in the cortex) are, in any given mental act, rather intensely energetic and hence conscious, and constitute the intellect. Those cells may be considered surrounded by some sort of difference surface (nobody knows what or where the variable boundary actually is: I am going no further than to state a mere mechanical truism), on the other side of which, and in fair balance with it, just as the filament is in fair balance with the field, is the remainder of the universe, the remaining nerve cells that directly are the emotions being immediately adjoining.

k. A number of variously stated truisms of that are obvious. One is that our intellect or conscious perceptions or sensations at a given time consists approximately of some certain cells; then at another time, with truistically changed perceptions, our personality is truistically composed in some measure of other cells; or, *the "seat of the soul" is variable.* Hence it follows that at a given time it is possible for two more or less coordinate souls to exist in one "person." E. g., one soul may be doing automatic writing while another soul is carrying on the usual routine; or less emphatically, most of us can at times read with our eyes and talk and think of something else. Also, it is truistic that there can be occasions when one part of the cortex suffers some abnormally great disconnection from another, so that distinctly different personalities may appear alternately in an individual. Such different personalities have actually been observed in the same person up to six or eight. Often a normal individual, by getting drunk with chemicals, will successively, as one part after another of his cortex is in effect disconnected by (say) the alcohol, exhibit a series of perceptibly different personalities. If he has normally used his top cortex to hide from people the unpleasantness of the rest of him, those other parts then show up undisguised—in vino veritas.

l. Such truisms of par. j may be multiplied indefinitely. The only other explicit one I shall notice is that practically always *Intellect...* may perceptibly give two general personalities:- (1) the general personal consciousness, or thoughts; and (2) a perceptible consciousness that we have that first consciousness—*self*-consciousness, or awareness of an ego. Thus we may more or less perceptibly bave at least two simultaneous consciousnesses—which is a direct and crucial proof tbat any part has an infinite regress.

§154. a. The expansion of *Emotions...×Intellect...=Will* (which expansion is largely a matter of writing it in terms of synonymous conventional symbols and indicating the implied quantitative differences) is all of psychology, and is so simple *in principle* that an intelligent child ought to be able to do it formally; but so difficult *quantitatively* (requiring such good observation and judgment of billions of perceptible structures that go to make one man) that the ablest men can not as yet do very well at it (cf. §§167l, 170). I proceed to discuss briefly some of the chief expansions, and sum them up in considering the One member *Will* in §157.

b. The earliest fairly definite use in psychology of a valid logic, and hence direct implication of forms of that equation, so far as I can find is in Dewey's "Psychology." James afterwards in his "Psychology" obviously tacitly used valid logic. But he said he didn't, and was vague and contradictory about it. Perhaps the majority of psychologists in this country now use sound logic.

c. Valid psychology in recent years has adopted the useful but dangerous (countenancing fanatics and fads) expedient of dropping old names for new, in order to drop the old "faculty" or dualistic errors. The chief new name is "the subconscious," and its rather verbally-irrational synonym "the unconscious." That new name is obviously equivalent to the ancient terms *emotions* and *feelings*, so that we have *Subconscious...×Intellect...=Will.* So far as I happen to have noticed, Morton Prince in "The Unconscious" first definitely dropped the dualistic idea that the subconscious is a dualistic faculty—a sort of fixed, constant sub-individual in us. Prince's logic, while not explicit, is valid, although he formally inclines towards infinite pluralism. Coriat's general principles, in "Religion and Medicine," are substantially the same in form as here given.

d. There has been much talk about the ideas of Freud. His theory is substantially this:- Dreams are always disguised realizations of suppressed or unfulfilled wishes, which in sleep can get past a "psychic censor"; those suppressed wishes may be referred to sexual matters. Further, mental antagonisms (one part of the mind or nervous system continually suppressing or inhibiting another) obviously fatigue the nervous system, and lead to disease if persisted in; so in cases of various unbalances the mind should be analyzed on the basis of dreams, and by the conclusions of such psychoanalysis the suppressions removed and a comfortable balance effected. —— Quantitatively, those ideas are useful, as we shall see; but Freud has the usual defects of the German materialists:- he persistently takes a part for a whole, or is a dualist. E. g., in ordinary everyday meanings of words, dreams are by no means always disguised, nor are they necessarily the realizations of anything in the shape of suppressed or other sort of long-entertained wish—all of which can be observed by any normal person who will take the trouble to (say) overeat just before sleeping, and repeat the performance until he manages to get a remembered nightmare. Of course, such a dream *can* be tortured verbally into being the realization of a suppressed wish (perhaps a wish that the owner of the over-burdened digestive apparatus might die)—for everything is ultimately identical. And Freud might logically validly express everything as sex; tbe reader has seen it done in §146. But Freud pretends to use everyday language—in which are named other effective instincts.

e. Clearly, "suppressed wishes" are merely the conventional *Feelings...*, and the "psychic censor" is *Intellect....* There is no real "antagonism" between the two, but simply an unbreakable, *interacting* relationship. At times we prefer to let what is ordinarily known as one sort of emotions become more perceptible, and discharge (proceed cyclically) as *Will*, rather than let another sort do so. In that case, *comparatively* speaking, one sort or set is "inhibited," just as there is more attraction or 'love' between some electrical charges than between others. Truistically however, if for a long time we keep one set of emotions in definite interaction ("harp on one subject" too much) we fatigue unduly not only the structures that engage in that "conscious" activity, but also the structures that are inhibited and do not get enough exercise. So if we *are* intemperate (unbalanced), truistically the brain sleeps unbalancedly ("poorly"), and some of the possible temporary personalities will *perceptibly* bob up as a dream. Obviously, we can not possibly "sleep" absolutely —any more than we can "die" absolutely. So necessarily there are, even in sleep, some parts of the cortex not quite so completely disconnected as others, and a slight unbalance

due to former fatigue of the brain or to some unbalance of other organs (or both: both interact on each other) may be perceptible as a dream. And obviously, the brain will neither go to sleep nor awake perfectly instantaneously. So there is always on the occasions of "waking" or "going to sleep" a period of especially perceptible dreaming. During those periods the brain truistically is partly disconnected although somewhat in working condition; so if a "suggestion" (any stimulus) be given it then, the suggestion can flow usually through only narrow channels, and hence it makes an unusually large impression on those channels; for obviously, ordinarily a large part of the cortex is engaged in judging and sifting and switching an idea or stimulus all about, so that its owner will not rashly follow some "wrong" "suggestion"; so ordinarily a suggestion will have a more distributed effect. That indicates the principles of the use of "suggestion," hypnotism (where a *part* of the brain by too much concentration is put to sleep—which truistically is unbalancing for a normal brain, but may be desirable in certain circumstances, just as running a Marathon may be), and such phenomena. The same thing is directly exhibited by hysterics:- A hysteric is a person with abnormally narrowed *Intellect...* (i. e., perceptible sensations are much less numerous than with a normal person; or a hysteric is never "wide awake"—hasn't an "open mind"), and hence she is very suggestible. But at the same time most suggestions made to her do not become perceptible to her, and hence fail. When one does "take" it "takes" hard—often producing "hysterics".

f. So we *can* judge somewhat from dreams (if we are good observers, with excellent judgment) as to what some of the unbalances of an unduly fatigued person are. —— It is possible to get one part of the brain so intensely working when awake that even though it is tired it will keep on working after the remainder of the brain is asleep, giving dreams that are an exaggerated continuation of consciousness —of the "censor" himself. —— Also, as modern life more often interferes with what are commonly called the sex appetites than with those given other names, it is naturally likely that more often the person who finds life a bit too hard will have dreams that give some of the sex nerves a chance to exercise, perhaps indirectly. I rarely remember a dream, but I do remember two vivid ones during the war in which I ate all the sugar I wanted. Neither the Biblical Joseph nor a Freud is needed to psychoanalyze those, and in ordinary language they were not the result of suppressed sex wishes—or suppressed wishes of any sort, as I never concealed from myself or anyone interested my wish for sugar. —— *But*, it is glaringly obvious that it is just as correct, in order to find out what his unbalances are, to observe the conscious mental life of a person. Except in occasional cases the mental balances are right on the surface in waking life with but slight disguises (§155). As a matter of fact, most dream analysis is sbrewd guessing from observations of conscious life. So a complete statement of a rational psychoanalysis is:- *Observations of dreams or other partial personalities that are usually emotions... × Observations of ordinary consciousness....*

§155. a. We have seen that even in the mental life of a person who when awake is badly unbalanced there is a tendency to get a general balance by means of the underworked parts exercising during sleep. When there is such a considerable persistent unbalance during waking hours that no such fair balance can be thus, or similarly, attained, then the individual truistically either will die, or else will go more 'insane' (become more unbalanced, so that *Intellect...* or perceptible sensation is more narrowed—in which condition truistically there is more hope that automatically rest and thus balancing will be obtained:- i. e., insanity is nature's method of balancing a man with the environment, by removing what we call the control of the matter from his hands when his own control, with only "normal" checks, is rapidly destroying himself). The general theory of that is clear, so I omit the numerous quantitative facts that are known. But before such a considerable unbalance can accumulate that there arises much dream-balancing, or hysteria, or double personalities, or aristocratic egomanias (obviously involving a narrowing of *Intellect...*—an inability to see other people very well); or before such a considerable unbalance can accumulate that there arise graver insanities with perceptible nerve lesions—before any of those nerve unbalances can accumulate much, there is a general more or less normal method of psychological balancing that is observable in everyone, is confusing even when recognized and understood, but which is conventionally unrecognized except in its quantitatively excessive form that is well known under the name *hypocrisy*. Havelock Ellis somewhat explicitly recognizes it as "Bovarism" in "Impressions and Comments." We may somewhat descriptively name it psychological reversal, or psychological or mental inversion, or much better, *make believe*. It is the psychological phenomenon less intense than hypocrisy, and so not quantitatively immoral (§163b). (Clearly, the milder stages of hypocrisy must be moral and useful—for truistically nothing that is quantitatively *wholly* bad [0 or ∞] can exist.) It is well known to children as make believe. It is the generalized *and balanced* form of the "glad game" or of Christian Science (§149fq): for sometimes it is more necessary to pretend a degree of calmness than to pretend joyous excitement. It is the mental phenomenon that makes it so hard to determine anyone's conscious motives (even our own).

b. There being but slight recognition of this mental phenomenon *as such*, and no conventional name for its more normal forms, obviously the way to make it known to the reader is to describe it in some detail—and even then some people will likely deny its existence. —— We may take the popular routine story writer and his readers as exemplifying make believe. Many men find the world monotonous, and seek a rest from an unbalance of bordom in excitement, in the unusual, in the vividly emphatic. For proof of that note the popularity of the movies—and in his day, of Shakespeare. Shakespeare hurls his meaning across with such violence that although the slang he used is three centuries behind the times, it still is sufficiently intelligible to me to be occasionally even painfully vivid; and his emphasis is still more heightened by the fact that what he says is mostly right and his poetic meter good (footnote 165d). The average writer has difficulty in finding or inventing circumstances to describe which actually are unusual and hence lacking in monotony, or in seeing them in other than the routine way, and especially in being self-consistent (i. e., right, "convincing"—as Shakespeare mostly was) about what he does see—and that lack of consistency truistically destroys to a large extent what he does say, so that his real difficulty is to *say something*. So our writer goes along writing what is intrinsically mostly nothing—and that in phrases so abused by misuse that they couldn't bear much load of meaning. So every once in a while he forces his *Emotions...* to give, so to speak, a hop, skip, and jump: he rising up to give in an apparently excited manner three cheers for this, that, or the other thing. (That is usually called pep and punch.) The reader lets or makes *his* emotions imitate those excitements pretended by the writer; and that artificial pretence of unbalanced emotions does work backwards in some degree and give the emotions some exercise, getting them slightly (*and pleasantly*, if attention is kept off the fact that finally the pretense is inconsistent, and not in agreement with the tremendously

exciting and also calm real universe) out of their monotony. I rather like to read such stuff myself, and enjoy it. There are some of those writers so fearfully inconsistent, though, that I can't stand them:- Holworthy Hall, Gertrude Atherton, Fannie Hurst, Kathleen Norris, Conrad, Hergesheimer.

c. Precisely that sort of make believe is more or less practiced by everyone—some going in the direction of excitement, and some in the opposite direction of calm. We may note several exaggerated cases that possibly run into hypocrisy:- The hard, callous man who will ruthlessly foreclose the widow's mortgage (perhaps quite justly: the point is that it hurts him negligibly to do it) often becomes a deacon in the church and pretends much sentimental piousness, and a sweetly concerned missionary interest in the "benighted heathen" who usually practice Christ's ethics better than he ever will; if he is a particular brute he may go so far as to build a hospital for suffering cats. The deacon helps to get his narrow egotism expanded a bit (and thus saves it from accumulating into a perceptible insanity) by glaringly advertising a kindly unselfishness he has very little of. —— The female parasite that becomes a "Society" leader and an ostentatious "charity worker" and "church worker," or a general community "uplifter," is pretending to herself and others that she has not the character of a parasite. And such make believe, or reversal of the original quantitative fact, obviously does give her some proper *Emotions*... and helps to balance her life mentally. Usually she does not know she is doing that, and will indignantly deny it. —— In the same way a kaiser or other demagog can not understand that he does not actually care for his people much, but exploits them. His unbalance has perceptibly to *himself* been balanced by a pretense of much love, and much *talk* about it. —— And in trying to get this book published I found that there are 'deacons' in science who do a large amount of talking about the need of "research," etc., that is make believe. E. g., Angell, now president of Yale, in my opinion talks too well on the subject (cf. his inaugural address, etc.). Before I could believe that there were such fine 'deacons' and demagogs in science I applied twice to Angell (while he was head of one and then another institution chartered to advance science) for help with this book—giving him some of the most competent endorsements of the book. The first time he wrote me vaguely that he imagined there were established "*precedents*" to guide in the matter. The second time he ignored it. I am sorry for Yale.

d. Children deliberately and consciously practice a normal, moral pretense in their games of make believe. James, without being very definite about it, in effect calls the same game by adults the "will to believe." If we deliberately assume—pretend to possess—what are ordinarily the psychological or physiological results of certain emotions, we in considerable degree cause those emotions in ourselves: mental phenomena work backwards (valid logic is circular). Actors often perceptibly exhibit the phenomenon of assumed emotions producing the actual ones. Obviously, when our unbalance is slight in degree, and we practice a correspondingly slight degree of backwards pretence of emotions, we can, and usually do, remain conscious of what we are doing. In that case, where there is definite consciousness of what we are doing, and no effort to deceive others, the process is obviously normal, and useful (primarily to oneself, or selfishly); and such a *quantitative degree* of reverse emotions I call make believe. In order to be normal it must be consciously and undeceptively an unbalance being balanced—it *is* an unbalance of course, and while permissible is not the highest type of either sanity or morality (it is the psychological aspect of the zone BC, B′C′, Fig. 163b). —— The deacon and the Society leader usually are so very unbalanced that their exaggerated form of psychological reversal becomes so real to them that it deceives themselves, and then they try to get others to believe it. And that over-doing or *intemperance* in make believe is hypocrisy (the psychological aspect of the milder part of the zone of the immoral, Fig. 163b), and is a mild degree of insanity not usually considered pathological—i. e., nature has taken control, *unconsciously to themselves*, and is trying to balance their brains: but as the deacon and the Society leader mildly fool themselves in only a few activities when they are hypocrites, they are mildly and tolerably insane—are just partly killed off by the universe or God. When the deception becomes general, so that there is a more or less systematized misconception in most activities (or when there is an *intense* misconception or seeing of things as they are *not*, in one or a few activities), then we customarily assert a pathological insanity. The "glad game" or Christian Science carried too far—not on appropriate occasions balanced by a reverse 'sad game'—is truistically a mania.

e. Therefore, a general test for the mental sanity or balance of a person, which can be readily applied, is to note whether he is conscious of what seems to other people to be his most pronounced make believe—whether he is sane enough to know where he verges on insanity (the man who is certain he is quite sane, that he knows it all and knows it right, is usually at least close to pathological insanity). E. g., that test of sanity may readily be applied to me:- In this book I emotionally pretend a calmness and commonplace conventionality that may sometimes not be in strict quantitative accordance with fact. I am quite aware of it: the method of make believe I use is that in every case of reasonable *quantitative* doubt as to the fact, I incline to emphasize its commonplaceness. That is what is recommended as rhetorical understatement; as a matter of fact it is admission of lack of sufficient strength to get along without that bias (cf. §149i): I do it for my own protection, so as to stay balanced with certain quantities. —— So make believe is the explicit process that is sometimes vaguely called mental self-control. To admit that we need to control ourselves—to be temperate—at a certain point is to admit that we are too weak to go beyond it (§159). And this make believe has been neglected because men object to admitting weakness explicitly (for obviously good reasons). So I have definitely shown that the man who disclaims any weakness in any respects, and consequent need of control, is really so weak as to be in imminent danger of a lunatic asylum. The direct result of avoidance of this subject of needed control, in the various special points we each need it, has obviously resulted in numbers of people passing the limits of normality into hypocrisy. An enlightened public opinion on the matter will largely stop it—and I judge cut our taxes in two.

f. The recognition of make believe has possible practical value in enabling us to play consciously (and hence sanely and rationally) a general mental balancing process instead of the theoretically one-sided glad game, or Christian Science, or proceeding in heedless and unwarned ignorance and becoming hypocrites. Such a practical "serenity" game is described by Dorothy Canfield Fisher in "Fellow Captains"; this section gives the theory which shows its ultimate rigor (cf. §170jm). And in addition to its practical value, make believe shows truistically that even in the man who superficially appears the most unbalanced mentally there is an actual close approach to a balance. It appears that hypocrisy ordinarily begins in a normal man as a conscious pretence—and then is not hypocrisy. But his unbalance for various reasons (for them, cf. the description of Fig. 163b) tends to become so great that his make believe becomes imperceptible to him

—and again strictly is not hypocrisy from his point of view, and so from a general point of view is a mild insanity. But he was *responsible* for his hypocrisy when it was on the verge of leaving consciousness; and in practical life we continue to hold him responsible until he passes into the zone of definite pathological insanity (§§157, 163). —— It therefore follows that everyone's *intentions* are always good. It is truistically impossible that anyone, *from* HIS *point of view* at the time of the action, can have an improper motive (§25)—on the same principle that man can not make a real error. That follows also from the theory of responsibility, and will be made clearer in §157 and the next chapter.

§156. a. This section sums up the quantitative principles of psychology. —— The Weber law or the Weber-Fechner law (I shall make no distinction; see "Ency. Brit.," "Weber's law," or James's "Psychology," I, 533-49) asserts, as presumably stating the results of psychological experiments, that in order that the intensity of a sensation may increase in arithmetical progression the stimulus must increase in geometrical progression—it being explicitly noted (1) that in all cases there is a limit at both 'ends' (usually called the upper threshold and lower threshold) of the perception of sensations; (2) that there is frequently a very perceptible time lag in the building up and dying out of the sensation (especially with "chemical" sensations of taste and smell); and (3) that usually those progressions are perceptibly inexact near the thresholds. —— For experimental details and discussion, see the authorities cited.

b. If we take *Emotions...*$\times$*Intellect...*=*Will* as being explicitly a standard universe, referring to the summed up sensations or sensation of an individual at a given small time interval, we may write it *Emotions...*$\times$*Intellect...*=*The given summed up arithmetical increase between the thresholds.* And the Weber-Fechner law asserts that those summed up sensations are roughly the result of geometrical progression in the stimuli [the *Emotions...*$\times$*Intellect...*]—which obviously is a truistic way of stating those equations (the $\times$, or the inverse square law, in the first members indicates such progression), and is in agreement with the argument of this book. Or, the Weber-Fechner law is orthodoxly stated thus:- the difference between any two stimuli is [as the *Will*, or as a One sum] experienced as an equal magnitude if the ratio of the stimuli remains unaltered (subject to the inexactness stated in the last paragraph). That is obviously identical in principle with Richards's general corrected gas equation (§82), $p...\times v...$=*A constant*—and hence is the assertion that psychological experiments are in agreement with all our general equations. It is thus proved in a directly experimental way that psychology or humanics is identical with "exact" science.

c. And it is directly obvious that this Weber experimental (psycho-physical) interpretation or truistic assertion of our general equation *Emotions...*$\times$*Intellect...*=*Will* is also an assertion of harmonic periodicity in a 'reverse' or 'time' way, thus:- We saw that in the case of atoms (structures of the same order) in general only certain fairly close approximations to periodical "elementary" sizes could survive in the same environment for a given duration of time. I. e., each surviving elementary size has an upper and a lower threshold beyond which the structure becomes unstable as a whole (because of its reactions with an always incommensurate environment). Now, in psychology there is a recognized periodicity *inside* the thresholds (which of course implies the reverse:- a similar periodicity of the thresholds). The Weber-Fechner law asserts just that perceptible periodicity inside a higher-order structure like man—a 'spectrum' inside the thresholds, and a different order of 'spectrums' of thresholds, in infinite regress. E. g., upon all humanic spectrums inside the thresholds there is superimposed a quantitative periodicity of normal and abnormal, pleasure and pain, good and evil, with *their* thresholds again subject to inexactness (as are all difference surfaces), and to the same time lags (§163). —— That threshold periodicity is probably anatomically observable. Thus we saw in §152c that there were seven (etc.) perceptible sorts of nerve endings. Theoretically, those of course indicate a periodicity of senses (hearing, temperature sense, muscular sense, etc.)—each sense being a psychological 'atom' (higher-order structure) analogous to an atom.

d. The proper mathematical statement of that quantitative theory is omitted. I have not formulated it, although a good mathematician could readily make an *abstract* formulation. But a somewhat definite mathematical statement would take me years to hammer out, as I know only enough details of mathematics to see that an explicit revision of calculus would be a necessary preliminary step, so that all conventional zeros and infinities may be handled consistently. But a general mathematical statement may be made similar to the mathematical theory in Marshall's "Principles of Economics" (6th ed., 838-58). His (economists') "marginal utilities" are "thresholds," and his "demand curve" $xy^n=c$ (840) more explicitly is $x...\times y...$=*Universe.* In that place Marshall shows fairly definitely the final infinite regress of superimposition of one spectrum on another. But before we get far on that infinite road to accuracy (as Marshall's economic equations show), the pains of complexity become more than the pain of a slight quantitative gamble or guess.

e. The general reader will nearly surely not understand the foregoing remarks in this section about the ultimate quantitative mathematics or measuring theory or periodicity of science. I am quite aware that I do not grasp it myself; i. e., at some stage of the game of going from *That* to *This* to see just what is the *complete* expression of the two I become confused with the details and quit the process with some residual inaccuracy. *Any* mathematical statement of it, regardless of the cleverness and ingenuity of its nomenclature and logical consistency, must do the same quitting at some point. Thus it appears that the difficulty of this section is not a difficulty in essential knowledge, but one of grasping infinite detail *in detail.* It simply can't be done perceptibly. But we sum up the details as a One readily enough. In short, in this section I deliberately got aboard the infinite regress, and kept persistently at describing it, implying the attempt to get at and seize the dots by mathematics, and the inevitable result is to me a perceptible *quantitatively* baffled confusion. If the reader has had enough mental endurance to follow on that chase (analogous to a kitten's chasing its tail), he too will feel baffled. —— But we need that explicit, conscious experience so as to know what to expect in the infinite regress. I used to be pained by it, and many people have been pained to the extent of making despairing *qualitative* errors about this fleshly prison, ignorabimus, etc.; but obviously, there is no need of feeling that way and we automatically will not as soon as we really understand the matter (it will probably take most people months to get over previous bad mental habits). The thing to do is to judge how far along the details on the infinite regress will do us any appreciable good—have any marginal utility, or in ordinary terms, are worth the trouble (of getting, using, etc.). As soon as we get that far, then truistically we should at once get off the regress by summing it into a universe or a standard universe (i. e., *acting* on the sum or *Will*, as implied in the next section). If in that process we have not had enough endurance to follow all the appreciable details (if we have not had enough mental integrity to perceive that it is raining, and that ordinarily we have to come in out of it),

then we can rest peacefully assured that the universe will accumulate enough effects of the overlooked details to force us at the proper time either to see them and react on them in a way to preserve our lives, or die. We all truistically finally die of the accumulation of such stupidity. But it would kill us even more promptly to hang on too persistently to any infinite regress; so we exhibit wisdom by reasonably guessing at how much stupidity to exhibit. —— This paragraph is the general psychological statement of the essentials of what is valid in pragmatism (see Jordan's Introduction for a better one). Any attempt to grasp too many of the Many is painful, and hence from our points of view as individuals is wrong and foolish (but cf. §159g)—even if the attempt be disguised in the mathematical theory which I indicated and even though all the mathematicians assert that they can fully grasp such *quantitative* details. Finally, Fechner, like other German materialists, substantially asserted that *he* could grasp the ultimate *quantitative* expression of his law. James ("Psy.," I; 534, 549), as a sort of germ of his future pragmatism, sarcastically repudiates the possibility of Fechner's being quantitatively so omniscient. —— The Puritanical conscience consists largely of an agonized hanging on to the infinite regress. Some of that—some "seriousness"—is obviously needed to avoid reasonable possibility of overlooking something important, and as a means of expanding limits of perception and increasing mental endurance and strength (§159). Such persistent "worrying" (or the up-to-date names for it are psychic complexes, Freudian repressions, sense of inadequacy, etc.—in everyday terms it is modesty) made able, fine, useful men of the early Adamses, Lincoln, and others who had the strength to stand it *and who had something* TO DO, thus *stopping* that mental effort at a healthy, wise, *balancedly* modest point, summing it into *Will* and thus getting a mental rest. But too much of it without the balancing *doing* made Henry Adams a querulous snob.

§157. a. We now consider *Will*, in *Emotions...*×*Intellect...*=*Will*. That term is the mental term that probably is most often used (both in everyday life, and in formal psychology) to name the summed up universe or personal standard universe from the mental or subjective point of view. Perhaps the term for the same thing which is used nearly as often is "thought" (or one of its variations). But as seen, nearly any psychological term may be used in a One sense. Obviously, anything which we find applying to *Will* also applies identically to any term which replaces *Will* in the equation: the only difference is that the various terms in a vague sort of way indicate standard universes of varying sizes when such standard ones are being used.

b. When we receive a nerve stimulus the energy travels through parts of nerve cells *toward* the cortex, and probably acts as a trigger to release more energy from the cells themselves (i. e., the jolt starts considerable secondary formation in the cells [they are "irritable" to such]: they renew that energy or structural loss from food). At any cell or cells in the path the energy may be very largely (or entirely so, as far as is *perceptible* in the cortex) collected together or focused (just as small asymmetries accumulate to cause a whirl to be given off); and then (equivalent to secondary whirl formation—this time in larger quantity) that energy from that 'focus' or ganglion is sent out in more or less branching nerve paths to muscles, which in their turn react with the environment (it may be some internal organ). As the environment gave the original stimulus the cycle is complete (but not exact in any finite space). Truistically (by the principle of continuity), all such energy cycles must affect in some degree the nerve cells that give conscious sensation (I shall take it that such cells are in the cortex—a quantitative fact supported roughly by observations). Those energy flows that go out to cause the muscles to move, will also in some degree irradiate and affect the cortex; and the movement of the muscles will also do the same. Obviously there is an infinite regress of reactions. All those sensations which only *vaguely* get to the cortex, and there are, *each of itself*, below the threshold of "perceptibility," are usually named emotions or feelings. Those emotions as an accumulation are perceptible. From them, truistically we are clearly but roughly conscious of our identity with the total universe; for obviously those conscious emotions necessarily include reactions with everything. At the same time other stimuli from the environment are strong enough to travel up to the cortex and be perceptible there. Even those stimuli are a *collection*; e. g., we can not perceive by any definite sensation a single atom, but get a sensation accumulated usually from many thousand atoms. The sensations which we (arbitrarily, as just seen) consider separately perceptible are obviously *Intellect...*. Now, as seen above in physiological detail, those "perceptible" sensations, together with the emotions in general, are focused in some cell or cells in the cortex (we can see now that the phenomenon is truistic with continuity). And as before, that energy must be discharged. We perceive that focusing *and* discharge and name it *will*.

c. Or, if the discharge does not at once take place to voluntary muscles, but first discharges partly to involuntary muscles and partly to other nerve cells, then that first focusing and discharge is usually not called will, but is named thought, or reflection, or consciousness, or nearly any other spiritual term. But obviously, even that phenomenon is identical in principle with "will": merely quantities are different between a discharge mostly to one set of organs (voluntary muscles) and one to another set (involuntary muscles and perhaps chiefly to other nerve cells). It is truistically impossible for the discharge to take place absolutely completely to any one part of the universe; in all cases some of it goes to other brain cells and involuntary organs and is reflected back as further emotions, etc., in regress. (There are no absolutely "involuntary" organs, but merely organs which can not be directly and with fair precision controlled by the cortex.) So the difference between will, thought, etc., is quantitative. And this paragraph obviously implies the principles concerning "men of action" or executives, thoughtful men, meditative or contemplative men, etc. The only one I need state is the obvious general one that no man *can* be *wholly* one sort, and that the normal, wise man will keep a fair balance of being the various sorts (cf. the evils of Adams's "thinking," stated in less precise terms in §156e).

d. In strict logic it is evident that the act of will (or of thought, etc.) is either definitely (1) the 'process' *between* the accumulation of nervous energy and its discharge; or (2) the whole process of accumulation and discharge (the whole process is obviously identical in principle with an electrical current). Truistically, in the first case there actually is no finite or pluralistic process "between" the accumulation and the discharge; the term "will" in such a view is a pluralistically non-existent limit or division between the two, or is a zero term. And the second case makes the "will" the continuous name summing all the infinite details of that accumulation and discharge in really unending cycles, and "will" is then infinite (possibly as a formal standard universe). In either case, will is obviously consistently *Will* in our equation —a One in full agreement with our whole argument.

e. And that gives the complete solution of the age-long squabble about the freedom of the will. We may look at the solution in two ways (the first in this paragraph; the second in the next). —— (1) The introspective observer

sees what he calls his will (or mind, or thought, etc.) apparently as a continuous and hence infinite affair, and promptly and consistently says it is free. Clearly, from such a point of view it can not *react* with *any*thing as it is everything, and hence can not logically be in any chain of cause and effect. Various systems of philosophy and ethics have been based on vague statements of that way of observing the will *as infinite*, or as at least a formal One. But on the other hand the observer notes that if he considers the universe divided into the Many (even if he takes that pluralism as being roughly perceptible parts of merely his own mental action), then his will is *not* any of those parts, but is a sort of limit to them—is perceptibly zero. In brief, a tangible Many "will" persistently eludes him;—as proof, try to touch it yourself, from that point of view. Then he in some way asserts that his will is nothing—that it is "worse" than "determined":- that he (his will) is the sport of circumstances, or that he is "predestined," or in the absolute clutch of fate, or "not as I will, but as thou wilt," or in Nirvana, etc., etc. —— This first way (with those two aspects:- ∞ and 0) of looking at the solution is obviously two One views of the universe—one aspect calling the will everything, and the other substantially calling the universe infinite pluralism so that everything which, like the will, then becomes a relationship or a zero limit between the parts is "nothing" with respect to the Many. *Or*, the second aspect calls the universe itself Nirvana or zero or nothing. There is a wide choice of expressions as to just what that Buddhistic or fatalistic or non-Anglo-Saxon view is. At any rate it is obvious that those two possible ways of viewing the universe give different *names* to the condition of the will; but clearly both classes of those names mean the same:- which in Occidental everyday language is that the will is free. (If the will is *zero*, obviously it is just as free as if it were infinite—as it is a truism that nothing can control a zero.) —— I have above combined the discussion of the relationship form and the One form of the three Trinity forms of the term *will*. That permits the use of clearer familiar terms. From a logical point of view it would be clearer to give the *three* views.

f. (2) The second and more common way of considering the Trinity puzzle of the will depends upon whether *will* is considered used in the One member or in the Many member of the equation. Obviously, by our Anglo-Saxon verbal agreements, if in the One member then the will is free. If a man observes himself (his will), so far as he can *perceive at the time* he does what he wants to (even when he says he does not "want" to do something, he obviously still prefers to do it for some remoter reason—to do it rather than accept the result of not doing it): he makes of *will* a standard universe and it is free. But he (1) can *later on* recall by memory his actions, and then see them as being his reactions *as an individual* with the *other parts* of the universe; or, he (2) can at any time observe other individuals reacting with other parts; and in each case he readily perceives that what formerly to him, or what at the time to the other individuals, was or is the standard universe free will, is, *in his now wider, and perhaps whole, universe*, a unit of the Many—that those standard *Will*'s now come over into the Many side as being parts:- as *Wills...*, or more explicitly, *Intellect...*. And of course, from such a point of view the individual will is determined. But with final accuracy, the person is really the total universe (§47); in that case his will is finally absolutely free (by Anglo-Saxon language)—for the obvious reason that there is nothing besides it to control it. —— The Oriental "predestination," although it apparently speaks of a determined will, now clearly means a free will (par. e).

g. That gives the general solution of the problem of the will, of reason, mind, thought, God the Father, etc. Obviously, the practical, everyday solution of the problem is that if we see *enough* of the universe—seeing that it as a whole works consistently and along the path of no resistance,—we ourselves completely *will* to go or be carried along that path. In that case, from our point of view, the will is free. But from a Many point of view our finite will is completely determined. If we fancy we resist going in that inevitable path we are merely suffering from stupidity.

§158. a. In this section we get the explanation of *memory*. —— In objective science our quantitative or Many agreement is that space is a fixed relationship which remains or endures. I. e., London and Chicago are in certain relative spaces which can at any time during a considerable period be objectively viewed in such fairly steady relationship by anyone who cares to verify such an assertion about them. Or, we can and do experiment objectively by observing space relationships or coincidences; and at any time the experiments with such space relationships can be fairly accurately repeated. So we say that space endures—or just *is*, and remains so;—that a structure or unit of the Many is objectively verifiable by anyone because of the formally fixed and constant space relationships. We can in theory perform an "experiment" in any part of space—and in practice, if we take the trouble to go there, etc. —— *But*, we commonly say that with time it is different—that we can "experiment" only in the present. Now, the obvious truth is that all of that "concrete" relationship of space has been asserted by means of using time, so that the space endured, and we could go about in it anywhere—*if* we had the *time*—and experiment. In short, the arbitrary, "concrete" invention space is the exact counterpart, formal opposite, or reacting part or symbol or mechanical balancer, of the arbitrary "mental" time. We do not conventionally say that there is any "mental" space—our "thoughts" do not conventionally "occupy" space. And in the same way our thoughts do occupy finite time, so that there is no "objective" time in the way there is objective space. —— Space is '*outer memory*' or objective relationship, and time is '*inner memory.*' Obviously, without memory or an arbitrary mental agreement of inner "duration" (just as "space" may be said to be outer "duration"), there can not possibly be an arbitrary enduring relating space. All that gives the "abstract" or relationship meaning of *memory*—its more usual sense. The real *present* is either 0 or ∞—a One term and-or meaning. *Nothing* pluralistic or Many can possibly happen in it. So we can not really perform any experiment in the present. *All experiments are performed in the past* and *remembered*. Clearly, by classic logic it is impossible to have any experiments.

b. To get the Many meaning of *memory* in perhaps the simplest way we may write the infinite pluralism equation *Many.....=One*, and note that we have been considering it objective. The subjective form (the form that emphasizes T of the implied L and T) is obviously *Memories.....=Meaning*. (If we put a Many term *memory* in our usual psychological equation it conventionally would be an *explicit* name for *part* of *Intellect...*, and implicitly a part of *Emotions...*; see rest of section: to devise a definite psychology with an equation ——...×*Memories...=Will* would obviously require mostly a new nomenclature.) —— So truistically *Memory.....* is the psychological term that corresponds to the "physical" *mass* or *M....* Therefore, when we use M in any science which implies the use of L *and* T (and all sciences do; IV) a part of its meaning is *memory* (cf. pars. c-e). Therefore, in *all* our measuring members M(*varying with*)L^2T^{-2}, the M rigorously and precisely means mass *and-or* memory.

c. The *mechanics* of our memory, as a matter of truisms,

are obviously as follows:- Any structure is the result, or "record," of what has previously happened to it in infinite regress. Evidently, every asymmetry in the universe has left its mark in any and every structure—has in some more or less minute degree modified that structure. So any present asymmetry of the structure exhibits in some degree *all* those past records. And that inclusion or identical relationship of the total past in the "present" asymmetry is *memory* —stated mechanically or physiologically, and giving *memory* primarily its relationship form. As all *M*'s truistically *are* such relationship, or (using conventional Many terms) are entities *in* such relationship (Part One), we see again that *a* memory is an *M*. So truistically all *M*'s have—*are*—an infinite memory. To assert that any structure has the ad infinitum record or memory of the past is identical with saying that its structural parts have a certain *L and T* relationship—*both L* and *T* being with finally correct equal emphasis included in the assertion. That, and the last paragraph, is hence essentially a repetition of §150d-g. —— The real difficulty in explaining "memory" is that its meaning is so glaringly obvious and continually used that there is the usual troublesomeness in disengaging, so to speak, the knowledge of it from ourselves and setting it off a little ways from under our noses, so as to look at it "objectively."

d. So truistically, if anything happens to a biologic cell (if there occurs an asymmetry in it) the cell tends to act in the same summed up way it did in the past, subject to modification due to the fact that the present happening does not exactly duplicate anything in the past. Hence there tends to be a rough general fixity of function and-or of structure on the one hand, and a balancing modification of it due to changes in the environment on the other. So in a fairly steady climate (environment) there goes on side by side a rather steady balance of (1) 'remembered' form and function and (2) a slight change to meet slight changes.

e. When such a monistic memory is exhibited by nerve cells in a degree that is objectively perceptible to us, but is not perceptible *as* a memory to the individual exhibiting it, we call it *instinct*; or if it is in a still lower degree of perceptibility to us we name it *reflex action*, or *tropism*, etc. And there is a vague degree of memory which so far as I can determine is experienced at times by everyone, that might be called an *emotion of memory*. I have that emotion of memory as an occasional vague feeling that some present incident and a great deal more like it happened to me in the far distant past—whereas if I examine into the matter I find that nearly surely it didn't. Apparently, the frequent occurrence of that emotion of memory to various people accounts for the belief in transmigration of souls. Truistically, in a One sense we do have a 'memory' of "past existences"—actually of *all* such existences. But the usual orthodox quantitative belief that one "individual" soul goes or transmigrates as a constant unit to a later one is obviously wrong dualism of the Maxwell-atom type. —— For years I have occasionally experienced memory-emotions when stimulated by some French word or phrase—particularly old names of places. It obviously would be quite easy to make an exaggerated quantitative guess that I am a reincarnation of a Frenchman, although so far as I happen to know I am over 95 per cent British blood, and no French (for the benefit of the anthropologists:- I am definitely Nordic type, cephalic index about 68—a marked long-head). Obviously, as it is theoretically possible for our emotions to dig out the most ancient memories in a vague way, almost any sort of queer belief (even the "insane" man's belief that he is Caesar) is based on adequate psychological cause, and is correct in a One sense. But usually such queer beliefs rest upon rather silly *quantitative* judgment. All the mystics are qualitatively right; but the average mystic states a preposterous quantitative hash.

f. *Memory* commonly means perceptible memory. Any nerve cell consists of whirls which are moving in certain paths; and that activity of the cell is normally probably just on the threshold of perceptibility. If a stimulus (asymmetry) comes along and speeds up some of those whirls the activity becomes (say) perceptible. That stimulus obviously does not change the total of the whirl paths much (the structural energy of the cell is enormous compared with it), but does probably change a few paths considerably. Now, if another stimulus of sufficient energy comes to that cell, as a general quantitative truism the whirls speed up to perceptibility in about the same paths as before, and hence the perception is somewhat of a repetition, or memory, of the first one. The second stimulus is somewhat different from the first, and so gives a perception *quantitatively* different from the memory also produced. Hence, the "feel" of the memory is different from the "feel" of the total perception—and also the "feel" of resulting irradiations (which result analogously to Huygen's law) is more or less different. So using that second stimulus as a standard, the partial result of it which is the memory is *recognized* as such a memory or *repeated* reaction. Obviously, the infinite regress is included in that definition and truistic proof of the existence of ordinary memory; and it is a circular definition. —— It is readily seen that memory can not be consistently defined or asserted by classic logic. E. g., by that logic a child's *first* perception can not be a memory, and he has no perceptible memories; then the second perception can be in part a duplicate of the first, but as the child has no single memory, he has absolutely nothing to serve him as a standard by which to judge that the second is in part stimulating a memory—and so on forever, he never having a memory. *In practice* the classic logic in effect endows the child's mind with absolute creative power, making the child God, who then in some unstated way manufactures out of nothing a standard memory, by which to know he has a memory. So classic logic essentially *assumes* memory (§35) —and can be shown in precisely the same truistic way to assume everything else. Therefore, the existence of memory proves by intimate evidence the argument of this book.

g. We now look at that memory process from the reverse point of view. As the whirls of a cell are moving in a certain general arrangement of paths, truistically only a certain stimulus (a certain general field asymmetry in the form, say, of an electric current) can readily "go through" it—be conducted by the cell in the stimulus's cyclic path from the environment through will and moving-muscles back to environment, and in or by that conduction stimulate the cell to perceptibility or consciousness. So a given stimulus 'searches out' its paths, and selects those made of cells already moving in 'periodicity' with itself. If the stimulus is very novel (is due to something unfamiliar in the environment—as the giraffe was to the man who saw one for the first time), there is no adapted path or memory rut for it to go through, and it is likely not to go through perceptibly; for it gets rapidly diffused by the resisting cells it comes to (the man in that ancient story showed that fact by his exaggerated assertion that there was no such animal). Hence, we fail to see some thing consciously and perceptibly until literally millions of practically the same stimuli pound and pound at our nervous systems until they (the stimuli) finally get "high" enough up or far enough along to be perceptible. E. g., an aristocrat —any hereditarily or otherwise "privileged" or "divine" person—is as such truistically "narrow" minded even to the extent of paranoia, and is hence correspondingly violent or coarse in his actions (is in an unbalanced degree an exquisite

or do-nothing and oppositely crudely active: e. g., Oscar Wilde, the Medici popes, and parlor radicals); yet the race for centuries took such aristocrats to be really the best because their actions were sufficiently unbalanced in both directions to furnish stimuli that would pound through nerve paths to attention. Those stimuli from the aristocrat were in fact uncommon or noticeable; but such easily noticeable unbalances are not the best, but tend to be pathological. Probably that fact as to the defectiveness of aristocrats, militarists, and all varieties of privileged persons has got up to the consciousness of the majority of people in this country, now that another and worse war has pounded it in; we now take such mental red pepper when we feel we need it by reading of the crimes and scandals of the aristocrats—in low life and high life—in the newspapers, with a saving knowledge that they are pathological. —— And we have the opposite aspect of the same thing (which is what makes us need such red pepper in varying quantities and form):- a stimulus may be so very well known that it goes through deep memory ruts so smoothly and continually that it causes no perceptible change and as a usual thing we do not notice it. That is another way of saying why it is difficult to express the obvious. Also, when stimuli go through thus easily we say we "believe" whatever it is that they assert, whereas in fact we usually don't notice whether it is nonsense or not.

h. The conclusions from the last paragraph are obvious:- Unless we already have fairly definite memories of a certain sort of stimulus, such a stimulus will not reach perceptibility unless it is comparatively violent or comparatively long repeated (or both). In either case the learning of the new thing is obviously likely to be fatiguing—perhaps painfully. Also, *unless the learner has a thorough grasp of the One* (i. e., actually has, at least vaguely, indefinite memories of *anything* which could be presented as a stimulus), the new stimulus he is to "learn" or incorporate into his nerve cells is likely to be so thoroughly unknown to him as to cause *fear*; and the "learner" may be one in a negative direction by taking active measures to get away from the stimulus. Fear is obviously merely the structural nerve resistance to a new stimulus that is violent enough to force itself painfully through partly into perception (so persons who are so "dense" as to be substantially impervious to an idea are "fearless"; §170r). On the other hand we may wear memory ruts so deep that conscious resurrection of the memories is difficult. In either case there is truistically a nerve unbalance or instability. The live person neither partly runs away nor partly dies by deep ruts, but is balanced by grasping the One.

i. The technical word that asserts that stimuli thus seek out their paths and cause perceptible memories, is *association*. Obviously, we could name as many "sorts" of association as we like (doing that used to be a favorite indoor game among psychologists); but all those names would be in effect equivalent to "cause and effect" or "relationship." *Association* is the psychologists' usual name for God the Holy Ghost. —— But often there seems to be, as an unfortunate legacy from the old dualistic faculty psychology, the dualistic idea that memories are distinct, constant-atom, exact things that are as such stored in pigeon holes in the brain to be taken out at any time, in perfect preservation. Truistically, all stimuli *in part* cause "new" ideas or perceptions (i. e., cause some ideas so novel that no perceptible memory accompanies them; e. g., breakfast this morning is perceptibly and uniquely *this* morning's breakfast, and not any other morning's breakfast); and *in the remaining*, usually much greater, *part* all stimuli cause "old" ideas—cause memories. So truistically memories of the Many can not possibly be preserved unchanged, or even brought to consciousness after a certain time (during which they have worn considerably). Quite likely anyone can resurrect a few *apparently* trivial memories that have been apparently unchanged for a comparatively long time: but only a small percentage of such memories can be resurrected —in proof of which try to make a list of what you ate at each dinner for a month past. Of course, in a One sense memories are all "there"; but quantitatively most of them can not be unchangedly stimulated enough to be perceived.

j. It is perhaps already obvious to the reader that it is possible to keep on and describe the whole universe in detail in terms of memory. It can readily be done with nearly any psychological term, because most are customarily used as each part of the Trinity. But the foregoing will have to serve, instead of the explicit volumes, to imply the expansion of the details, and to show that the expansion is identical with the expansion of the description of anything.

§159. a. It has become obvious that there is no essential difference between any two so-called faculties. Ideas and perceptions and concepts and memories and sensations, etc., are all essentially the same; the difference is quantitative:- some of them contain more of quantitative time *and* the implied space, and some contain less. Usually that difference takes the form of collecting some whirls (formally at least: nobody has 'measured' the actual facts) into a unit "higher" structure (and such quantitative difference will have to be considered by the laws of periodicity, inverse square, etc., when such measuring is made). Thus, a concept is usually taken as a collection of ideas (some sort of nerve structures) *organized* together; a law is a higher order of concepts, etc. But obviously, when we say *That...×This...=Meaning* we have asserted that always there is such an organism or relation. So our psychological equation *Emotions...×Intellect...=Will* asserts all those possible quantitative variations in psychological terms. Such quantities are in detail usually considered to be ethics;—the development of the measuring member would definitely be psychology, until such time as that naming of measures also took on a definite meaning of normal or abnormal—right or wrong. So I shall not verge further on ethics here, but close this chapter with this section, which gives a general quantitative summary of the psychological equation by showing its application as (1) the mental solution of *any* problem, and as (2) the statement of the character or 'properties' of genius.

b. Obviously, if we have a "problem" it is expressed as *That...×This...=Meaning*, and has its "mental" counterpart as *Emotions...×Intellect...=Will*. As we have seen (Index, "Explanation"), the problem is "solved" when we have so many dots perceptible that some of them are familiar to us, and we recognize that the dots with unbreakable relationship run in infinite regress. So the mental method of solving any problem is to keep on looking at whatever it is we want to know about until the various stimuli from it force enough perceptions or sensations into consciousness for us to see their unbroken relationship and to see that they are familiar—*and hence may be correctly fitted in to our living*. Of course, all the stimuli or dots which do not become perceptible *are* related—as we know after we have once grasped the solution of the One and Many. But sometimes in order to get a surely familiar (i. e., 'fitted,' useful, applicable) one it is necessary to make those stimuli from the thing keep on coming in for years before the right stimuli will get through to perceptibility. There is no need to "try" to "relate" or connect the perceptible ones into a "system" or organization —into concepts or laws or those pernicious baby-pacifiers called hypotheses. They *are* so related—as parts of the universe,—and the object is to keep struggling until we *see* the details and *hence truistically their unity* or relationship. That

of course *indirectly* amounts to trying to relate the perceptions; but the emphasis is different:- when we "try" to make concepts that are those pernicious hypotheses, we have our attention on the matter of *relationship*, instead of keeping it on the thing itself (men in the past then usually got excited and tried to "prove" the relationship—which in practice means irrelevantly to clamorously assert its existence, and is worse than painting the lily). The relationship exists; and if we are intelligent we know it exists before we start: so we should put our effort on *seeing* the thing as it is. When there are *enough* details perceptible they automatically snap together into an obvious relationship in our brain—the nature of the universe makes them do so (it is a truism that they do) and not any "effort" on our part. And until there *are* enough they truistically will *not* systematize—and that is all that can be said of them. The man who tries to "force" them to do so, calling the result a hypothesis, thereby shows that he is innocent of making or "discovering" any laws, and does not even know what such a process may be. We do *not* formulate laws or "great" generalizations as if we were the capricious God of the dualists: we pound perceptions into our minds—observe and observe and work to observe some more—and the laws 'formulate themselves.'

c. That is the whole of the method of "solving problems." Every man truistically is competent to solve any problem (even if he is a congenital idiot) *provided* he can keep on pounding in stimuli long enough and hard enough. The idiot quickly gets tired of paying attention and quits (that is what an idiot is in psychological quantitative terms—an early "quitter"). The man who formulates laws also gets tired of paying attention, but he does not quit so soon as the idiot, or confine himself to an eight hour day (although of course many persons are too weak to work well even eight hours). As a general rule heretofore, the man, who by some means more or less accidental so far as he "purposed" or anticipated (and always those means resolve themselves into sufficiently intensely and *persistently* pounding stimuli in)—the man who by some means had once got a grasp of the One or whole realized that a relationship did exist between the things he was observing (and also between them and himself, so that he was "interested," or knew that they mattered, or that his work was worth while, and hence worked vigorously with no energy wasted on considering "what's the use?"); so he was able to take his mind off the effort to see relationship, and put it at seeing the things. Naturally such men were able afterwards to solve many problems, and were able to avoid getting so tired that they practically had to quit. But it is now definitely proved that such a grasp of the whole is highly useful, and how it is; and it is shown just how to get it. So it is possible for anyone consciously and with a positive and correct method to go at solving any problem —and solve it if he does not get so tired as to quit. Some men have tougher brains than others, as we shall see. Religiously or qualitatively men are alike—are *essentially* alike and absolutely equal. Quantitatively, or in a skin-bounded sense, no two are equal—just as no two atoms are equal.

d. The last two paragraphs are rigorous theory. We may now look at the Many aspect of solving any problem. There are, so far as I know, only two quantitative tricks that are of much importance in solving problems (perhaps other men will find others of more importance for them). One is to learn the "feel" of persistently grubbing down into our vague ideas and memories—into *Emotions...*, or the modern subconscious,—so that we can tell when the perception feels as if it were coming up clearly; then we are able to keep on at just the right time until we yank up into perceptibility the sensation (observation) we need. That sensation is always there and will come up if kept after long enough, and if we keep on taking in additional observations from the outside to reinforce it as may be necessary. It is difficult to keep on when the perception with vague consciousness first comes—there being then a strong desire to call it finished or observed, and to spout the resulting half-baked ideas as a lot of sentimental mush (often called "idealism"); the trouble with Woodrow Wilson was that he indulged himself by usually quitting important things on that last hard but essential lap (hiding the indulgence from himself by polishing phrases and performing other trivial and easy austerities); all aristocrats become so by indulgence on that last fierce lap—as I happen to know from having tried it for a while. That digging after perceptions can be made more successful by getting into an environment that makes the worker mentally uncomfortable and irritable. Apparently the best way to achieve that emotional irritability is to overwork (that can be controlled and irritating associates usually can't): of course the solver has got to pay for that irritation in decreased health. That discomfort, like all quantitative things, can be overdone (§163); at a certain stage the solver's digestive apparatus will get out of gear, and fail to feed his brain fast enough, thus counteracting the irritation's good effect of shaking ideas loose from the bottom. A minor trick I have used is to eat much sugar and a little chocolate to make my brain work vigorously and also irritatedly. Tea and coffee and tobacco happen to work too violently for me; and I think the present version of the book is made much more balanced and reasonable by the war's having habituated me to a normal consumption of sugar—although I doubt whether I could have done the preliminary rough work without it. —— The second general trick of solving a problem is to go at it in the reverse way when we get too tired of one direction. All our everyday formulas have two terms, *That...* and *This...*; when the brain is so tired that it will not work well to pull up more dots of *That...*, then start on *This...* and dig up a few dots of it. —— Any normal person, by applying those simple principles, devising quantitative means suitable to himself, can solve any problem if he can keep at it. But he will have to pay for it by wear and tear of himself—which as a general rule will be replaced by better growth up to a certain point of 'reversal'—of "elastic limit." —— And I have unavoidably above given the impression that digging out this book was "hard work." Being interested, I have considered it play, and have for so many years automatically used the phrase 'when I finish the book and go to work,' that my associates adopted it. So solving life properly is fun.

e. From an objective point of view genius consists of the genius's having a body, particularly a nervous system, strong enough to stand intense work for a long time. Or, put in terms of the psychological equation, the genius is a man who can endure an unusually large amount of both *Emotions...* and of *Intellect...* (of vivid feelings and perceptions), and keep on standing them without becoming so painfully fatigued that he quits. Obviously, that is merely a quantitative, unessential difference from the average man. That man is of precisely the same *quality* as the genius—is fundamentally and in principle the genius's equal, and so can use himself as a standard by which to judge a genius; he also, as a truism of the biological equations, can train himself, by reacting with the environment, to endure more and more work and thus acquire nerve strength and irritability—there are no measures as to how far the average man can go in such training in his available time. The average man can see that he himself ultimately, and in a real, accurate sense, is God: his definite perceptions of that identity quantitatively include a certain part of the whole infinite regress of possible ones.

The genius has more numerous perceptions and more vivid ones; but clearly his can not be essentially greater. The genius is not so much of a quitter as the average man; so he lives more of life in a given calendar time.

f. The insane person also has vivid departures from the normal balance. The important quantitative difference between him and the genius is that the insane man is not sufficiently conscious of his departure from the normal balance to be able to come back to a balance and compare his departure with that, and also recuperate. In short, the insane person has gone so far from the normal that he has structurally damaged his nervous system (or vice versa, if preferred; the actual process is usually small cyclic steps in a "vicious circle"); so he can not really do the work required of genius. The genius can stand the same departure without perceptible damage—just as one person tears a muscle with a load that another carries with ease. So the insane person truistically shows exceedingly poor quantitative judgment about some things—usually not about many things. Unless his insanity quickly kills him his nervous system achieves a "natural" balance by having some part of it become very narrow in the limits it tolerates, to compensate for the wide vagaries of the damaged parts. In those narrow parts he is truistically apparently saner than the average man—is *radically* conservative or is reactionary or stand-pat. —— The real genius on the contrary can shoot out to wide limits in any subject—to limits perhaps wider than the insane person's—and do it at will; and then return to a normal balance, and judge with fair accuracy how far he went, and the quantitative proportions of all things he observed on those excursions from the normal. So this proper sort of genius would be a better balanced man than the average man—would live a more normal and steady life, and his opinions or judgments would be considerably more sane (i. e., more accurate). —— Well; as a matter of fact, so far as I have observed, the men who have been usually named as the world's great geniuses have failed to reach that theoretical superior balance in at least a few things. They apparently all shot out so far in one or a few respects that they damaged their brains and did not have good judgment in such matters afterwards—were fanatics in them. Generally speaking, the average man has taken a few similar flights in genius, and has become mildly fanatical or a practically permanent crank or eccentric. But he is still better balanced, even as an individual, than those acclaimed geniuses, as he didn't usually shoot out so far (cf. §171k). —— I am quite aware that on whatever subjects I happen to be, unconsciously to myself, a fanatic, in those subjects I am unable to recognize other *similar* fanatics as being fanatic: and I would consider as being fanatic in those subjects those who are not. So in strict principle I am incompetent to judge whether those acclaimed geniuses have all failed to reach a superior balance. This application of the principle that there is no exact science is respectfully urged for consideration by those who are cocksure in their opinion that others may be fanatics and cranks, but they themselves never.

g. So obviously the man who insists on his right to be erratic, or unconventional in many minor things—upon his right to have an "artistic temperament," or to have any sort of special privileges (he usually disguises that crude demand under some such queer phrases as "living one's own life," "the new freedom," having a "career")—the man who insists on such "rights" is demonstrating his own inferiority; is demonstrating that his brain is too weak to avoid that mild degree of unbalance or insanity called fanaticism. So truistically it follows that all the pre-war Teutonic chatter about the superman is ordinary fanaticism. For, to repeat, there can be no man essentially superior to another; and the quantitatively superior man exhibits his superiority not by an unbalanced, "peppy," noticeable departure from the normal, but by a closer, more delicate adjustment to the normal, and by his temperate preservation of average standards. That genius has to make wide departures from the normal in order to gain experience and judgment as to how to keep more balanced; but he makes those departures so far as possible at his own risk and expense, and as a necessary evil instead of a praiseworthy performance, and does it unobtrusively, and goes as little away from the normal as will serve—with the clear knowledge that it is insanity and death to persist in those departures. On the contrary, the aristocrat, particularly the exaggerated superman and "artistic" type, considers that just the opposite conduct is proper. The ordinary socialist and the "red" type—the contract-breaking, output-limiting, class-conscious workman—are precisely like the other kinds of aristocrats in persisting in departing from the normal. I think an intelligent child can see how wrong those two sorts of aristocrat or radical are.

h. The genius receives impressions from the environment and those cause him to work to get more, and so on until he has a very full life—lives more. Most other people note that sort of life and want it. But many decline to work to get it; so they fail to get enough exercise for their abilities, whether they be muscular or mental (or both). Hence they develop a chief make believe of verbally railing at what they call their monotonous, uninteresting, meager, unsuitable, etc., environment, and at their narrow circumstances and lack of opportunity, etc., etc.—you probably have heard it; labor leaders will demand shorter hours and then in the next breath thus bewail the natural result of loafing. It of course has become easier for those make-believers to talk that way than it is for them to go to work and use the infinite opportunities for seeing and living that lie right at hand, and the talking widens their horizon a little—balances them some, as we saw in discussing make believe. Obviously, truistically that talk sets up all aristocracy—miracles, something for nothing, privilege—as a desirable goal. Then some of their neighbors who are more energetic (such as kaisers, popes, demagogs, and all grabbers and grafters whether of academic honors, Society leadership, fame, or cash) take that guessed-at goal of mediocre make believe as being the real thing, and go chase it. Thus the "upper ten" and the "submerged tenth" actually directly mutually support and cause each other—the numerous stupid weaklings formulating the "ideals"; as the tramp and the kaiser are both after the same thing (dualistic miracles, something for nothing), it naturally is needful to give them the same name:- aristocrat.

i. Mostly I have verbally taken the conventional point of view that genius refers to mental ability. Mental endurance is of course truistically the "representative" ability of the whole individual, and is also the rarest in the direct form of *Intellect...* . But obviously, anyone who exhibits the same delicate, conscious balancing or poise in his life, is equally a genius. As a matter of obvious truism, the real genius can not be so one-sided as to exhibit merely good *Intellect...*—a fact shown best I think by Howe, who has an extraordinarily well balanced intellect and hence knows its place ("Ventures in Common Sense," and "E. W. Howe's Monthly"). He must also exhibit a balanced whole life. I am convinced that a good mother needs and shows the highest type of genius.

j. All that quantitative description of a genius—a person with excellent organs—is clearly general, and is indefinite as to what structures, etc., constitute such organs. No one knows very much about that. But I have given a wide circle of truistic description of the genius, and in principle anyone can enter himself at any point in that circle that comes easy

to him, and by sticking consistently to it, make of himself in his own environment his own particular sort of genius—which in the end means mostly a person sufficiently widely and vividly experienced to live, and to enjoy living, an exquisitely temperate life (which by no means is an ascetic life; XVIII); then secondarily he adds to that as great performance according to his special capacity as he can. *Breeding* is perhaps the best name for such genius, that produces the only sort of useful and enduring work—except that in practice "breeding" has been somewhat grabbed by the aristocrats as a name for coddling, emasculation, and subsequent hysterical forays into imagism, cubism, or whatever be the fashionable cult of the day. I should call Lee, and Ford, and Rockefeller well-bred, and the latest New York Society leaders mild boors.

k. The foregoing description of genius has been mostly from the objective point of view. Many geniuses have said what genius is, from the subjective point of view of their feelings. Those avowals mostly divide into two sorts:- (1) that the genius they exhibit consists of the fine frenzy of creative work; (2) that the genius exhibited consists of the delightful peace and sense of belonging properly with things and hence of getting all of life, which follows that fine frenzy. Both sorts of geniuses are in substantial agreement that the frenzy comes from "outside"—naming it inspiration, revelation, etc.

l. Their agreement that the frenzy comes from without themselves tacitly takes for granted that they are bounded by their skins. Thus they assert that they themselves did not create any of the relationships that they saw—that those relationships existed. That much of their avowals is consistent (par. b). The rest of the conventional implications of "inspiration," "revelation" is truistically nonsense. Those geniuses observed the universe and saw that it was beautiful or completely fitted together; and that gave them a rebirth (§153), which ultimately consists of the consciousness that they themselves are an inseparable part of the universe—a beautiful fit, reacting and hence useful. That part of their "revelation" was usually so vague with them that they in general effect *verbally* contradicted it by implying that they personally were apart from God or the universe so that the revelation had to be handed "down" to them. So far as I know, Christ was the genius most definite about the fact that the essential truth is that he too was an inseparable part of the whole—a Son (§162e). —— Any fairly intelligent person can readily see that the general agreement of geniuses is essentially that they had a rebirth in some degree. And any person with a fair amount of mental endurance can readily experience a rebirth, and thus subjectively experience in some measure precisely what the geniuses did.

m. Most geniuses seem to hold that frenzied "creative" work is a desirable departure from the normal. We have seen that such unbalances are not themselves good (par. f). But so common is that defective view that insane persons are sometimes mistaken for geniuses. —— But as noted, others hold the opposite view that genius gives a sense of peace, and of a blissfully calm and finished universe or God.

n. Clearly either way is correct as a One view. In a practical or quantitative view, the temperate conclusion is that the genius will avoid exaggerating or overdoing either the peace aspect (which may expand into Buddhistic or Oriental quietism, or European mistaking of laziness and inert self-indulgence for cosmic "leisure") or the frenzy (which may expand into mania, or the New York pained hurrying to nowhere in particular or wearisome "punch" at nothing special). So you have to decide for yourself what is a temperate, exquisitely adjusted balance of the two for you. Christ seems to have recognized the two classes of genius and their tendency to exaggerate their partial point of view, and for himself to have adopted an excellent balance. So again, in the next most important fundamental point in full living, Christ was correct. And Lincoln was explicit both in word and deed about the need of such balance in life.

CHAPTER XVIII. *Ethics and Economics.*

§160. a. Ethics is the branch of science which chiefly expresses whether or not we as persons like a given thing—the science of happiness. It expands, according to vague general agreement, into the applied science of how to get what we want or like, and avoid what we do not like. We vaguely and indefinitely call what we like *moral*, and what we do not like *immoral*. Sometimes with even more conventional vagueness we put a neutral collection of *unmoral* things between the moral and the immoral—those being the things that are almost perfectly balanced as far as is perceptible to us. So ethics is frequently said to be the science of morals. The moral and the immoral commonly tend to be named thus from a "subjective" point of view. From a more or less "objective" point of view the moral is termed the good, and the immoral the bad or evil or sin. So from that view ethics is the discussion of the problem of Good and Evil. But as "objective" and "subjective" are ultimately identical and are necessarily both included in any science (XVII), and as everyday ethical conclusions tacitly agree with that conclusion by making no definite distinction between "inner" and "outer" good things, I shall not bother in this brief discussion of ethics to make such formal distinction, except to show (§161b) that those two great technical schools of ethics, hedonism and idealism (which respectively go after or approve objective morality or "pleasure," and inner morality or "ideals" or "virtue"), are identical in meaning, and not opposing and dualistic as often conventionally held.

b. Ethics as such a science is emphatically a collection of quantitative or Many judgments—as we see definitely as we proceed. All mental and material things are ethically judged from the point of view of our personal Many selves as criterions. If those things have no unbalances or asymmetries perceptibly affecting the survival of ourselves, then truistically with that neutrality we say they are not "news," not "interesting," practically "negligible," or, formally, are unmoral. If—emphasizing L—those things are a little further away from the exact balance, we perceive them, and like them because they are within the limits of asymmetry that conduce to the continued existence of our structure. If they go a little further from the balance (Fig. 163b), they come into a questionable zone, in which we do not know whether they are more pleasant or more painful; they are "startling" news, and are of dubious or questionable morality. Still further away things become unquestionably painful or damaging to our organism, and we name them bad or immoral. E. g., under ordinary conditions, to drink a drop of water is negligible; a glassful, pleasant; two glasses, perhaps doubtful; and several gallons of forced drinking, probably fatal. —— And the same quantitative variation in the "goodness" of a thing occurs when we emphasize the T point of view. Thus a raindrop hitting us is usually unmoral; speed it up some and it gives a "stimulating" tingle; but speed it fast enough and it will be fatal. So obviously, to get a comprehensive idea of what is good and what bad, we have to be explicit as to L and T—something that conventionally is only vaguely done (e. g., we then see in §165 that "economy of time" is an important ethical law that is conventionally sometimes ignored even in practice).

c. All such conventional ethics expand still further into asking *why*. Or, that extension may be called an expansion into the One—to infinity; or to its logical equivalent, zero or Nirvana. That expansion of ethics is ordinarily called religion. I. e., *conventionally ethics* refers to the Many, or science, or pluralism, or quantity; and *religion* refers to the One, or what is *formally* non-science, or monotheism or monism, or quality. Or, if we write our ethical equation in the form *Idealism...*×*Hedonism...*=*The Good, or Morality*, the Many member conventionally is ethics, and the One member religion. By our total argument the two are essentially identical: there is merely the formal difference between them that there is between the Many and the One. And I shall make that formal distinction just as I have made the same general distinction throughout the book (§39). Ethics *sums* into religion. It is obviously not possible to state any *valid* ethics or *any* valid science which does not.

d. *Theology*, to be definitely consistent, must include as being identical, ethics *and* the sum of ethics into religion (cf. §39). Thus theology would omit the summation of other sciences into religion. But orthodox theology purports first to be a science (it actually tries to be logic, taken far enough to prove the existence of God). And at the same time it dualistically purports to be not science but religion ("Ency. Brit.," xxvi, 773; cf. remarks of Ryan, footnote 49b); e. g., the average theologian seems determined that the warfare of science and theology means the warfare of science and religion. So theologians are broadly inconsistent as to what they are, and as to responsibility for what they say. —— (1) As a science, all of conventional theology that is called Christian which I can find holds God to be essentially a different sort of being from man—a sort of superior, divine (as absolutely opposed to human), aristocratic potentate like a kaiser, who by fiat created the world, and by his autocratic will now irresponsibly rules it, etc., etc. That dualistic theology is obviously, by this whole book, wrong. Also, as Christ seems to have held as being his fundamental observation that he was inseparably connected with God and man (§159l), then orthodox "Christian" theology is not Christian but is flatly anti-Christian, as it contradicts Christ fundamentally. (It may be held that Christ is in places reported to have held opposite fundamental views. If Christ did hold such opposite views, then I flatly repudiate Christ's fundamental teachings as being wrong: and this whole book is verifiable proof that they would be, in such case, wrong. But what Christ actually did teach is obviously a quantitative or historical problem that can never be absolutely solved.) —— (2) Further, so-called Christian theology for centuries was largely based on the doctrine of apostolic succession—which is still held by many theologians. That basic doctrine is in substance this:- essentially, the ecclesiasts have been (in some claimed mystic way) given a dualistic "divine" right to rule the members of the church (and others, if the others will tolerate it)—an aristocratic privilege which clearly agrees essentially with the claim to rule made by kaisers. The world has had probably more trouble with the churches' dualistic "divinity"—with that ecclesiasticism which perhaps a majority of theologians claim is religion—than it has had with kaisers' identical claims. In so far as conventional theology quietly tolerates such essentially wrong ecclesiasticism, to that extent theology is nonsense. *If* Christ did give any such power to church authorities or meant to give it (as he is reported to have done by one writer, Matt. 16, 18-19, in a weak pun made in a language unknown to Christ—and for that reason alone probably a forgery), then it is proved by the total of this book that we either have to repudiate such an error, or be irrational aristocrats ourselves, and like the theologians who hold the doctrine, set ourselves up as being essentially better than ordinary folks. —— (3) Further, as a last fundamental doctrine, the theologians tend to claim that the Bible is "inspired" in some essential sense, and "hence" is correct. The claim is logically completely wrong, in any definite, positive sense; of course, in a One sense man can not make an error, and it is fairly easy to see that the Bible is the inevitable result of certain conditions, and hence accurately displays an ultimate chain of cause and effect, and so is ultimately right in a mystic, ineffable way. But it has been so often shown that the Bible repeatedly actually contradicts itself, and gives many evidences of having been in spots forged by grafters and deluded fanatics, that it would tend to be a calumny on the mental integrity and enlightenment of the fairly unbiased reader for me to assume that he needs to have it explicitly shown him here. —— Therefore, as on those fundamental things orthodox theology is so obviously self-contradictory, stupid, and disingenuous, I can not decide just what theologians think theology is.

e. The final general remark needed in the introduction of ethics is that the tacit verbal agreement underlying all of ethics is that GOOD *consists of activity or life, and* EVIL *or bad is the absence of activity or death*—the basis of quantitative guessing as to the amounts of such good or happiness, or evil and unhappiness, being their perceptibility or consciousness.

§161. a. Fundamentally, we consider that to be good which *is*—which exists. Ultimately, unless we commit the silly self-contradiction of asserting a defective, wrong universe or God, we believe and assert that whatever is, is right—is, from a *universal* point of view, good. Possibly our word *God* etymologically simply means good—the sum total that is good. Words for God in other languages mean Being in a general sense—like our phrase "Supreme Being." In still other languages the word for God seems to be etymologically an assertion of human striving to expand consciously into universal being—by prayer, etc. So it seems to be a historical fact that in a One sense the Good is that which exists, and is otherwise verbally called God. By our solution of the One and Many, truistically the One is absolutely good (also, anything else), so that whatever exists is good. —— If we say the One is good, we can not *by the same language agreement* say it is evil, or that any part of it is bad. But if we wish, we can change our total language agreement, and say that the One is absolutely evil. That would not agree with conventional verbal names; but it has been repeatedly shown in analogous cases that the final meaning would be the same —*Evil* would simply be what we now name *Good*.

b. We thus see explicitly, as a truism of the One and Many, that our whole basis of ethics or good or God is the observation that they are synonymous with existence, or being, or life in general. "Really" or monistically good, right, morality, God, existence, being, energy, *Meaning*, consciousness or reason, and life in general or activity, are synonyms. In the last paragraph we have seen that not only is the equivalence of good and life and God a principle tacitly accepted by men for ages, as is more or less clearly evidenced by etymology of words, but that it is in agreement with all the proofs in this book. So far as I can judge, all the many schools of ethics in general effect accept and start from that One principle ("Ency. Brit.," "Ethics"). As stated in the last section, those schools divide into two sorts:- (1) one is verbally "objective," emphasizing *L* or 'outer space' more, by preferring to call Being *energy* or *life* or "*things*"; and its adherents are called hedonists, epicurians, utilitarians, evolutionists, biological evolutionists, and various other names denoting shades in doctrine; and (2) the other school is verbally "subjective," emphasizing *T* or the "inner life" more,

by preferring to call Being *reason* or *conscience* (a synonym for One consciousness), or the *ideal*; and its adherents are called idealists, rationalists, intuitionalists, and various other names indicating minor differences in doctrine. As is clearly recognized in conventional ethics, the idealists or intuitionalists are vague but comprehensive or extensive (thus emphasizing *Emotions...*); and the utilitarians are concrete and definite or intense (emphasizing *Intellect...*). So obviously we have the ethical schools united in the equation *Idealism... ×Utilitarianism...=God, or Good, or Life.* Clearly the two schools react oppositely verbally, but actually supplement each other, and are not contradictory as is orthodoxly held by classic logic. —— There are many books of controversy between the two schools. The total battle is essentially identical with that over the problem of mind and matter, and it is perhaps unnecessary to repeat in further detail than just given the solution of it in technical ethical terms. We *could* go ahead and expand ethics in terms of that equation. It theoretically would be an excellent way of grasping ethics. But there is the practical difficulty that our ideas of that equation are decidedly messed up by the dualistic Paul in the Bible. He recommended (so far as I can pick a consistent statement out of his self-contradictions) that this present evil world (or *Hedonism...* or *Utilitarianism...*) be made zero, and that the world of the spirit be made the total goal—be made infinite. Paul's logic in the matter is very confused; he was continually tackling the problem of the One and the Many (e. g., I Cor., Chaps. 12-14), and usually 'expressed' his form of solution by denying both essentially and formally the Many which he had just the minute before been using to express the ineffable—a form of obfuscation still a favorite among doctrinal theologians and other aristocrats. So if I were to start expanding that equation in ordinary intelligible terms the reader probably would shortly be in a nearly helpless and highly irritating maze of verbal contradiction between his long familiarity with Pauline stupidities, and things as they actually are when named by the same names. Paul and Kant are very much alike; both vigorously deny *in effect* the need of paying serious attention to the Many, which both vigorously use to express themselves. Paul's remarks were influential in producing the Inquisition and other ecclesiastical atrocities which still continue (cf. footnote 172c); and Kant's, the nearly equally unpleasant world war (Dewey, "Influence of Darwin on Philosophy, and Other Essays," 1910, p. 65). Both men were too unbalanced to get along well with the Many; Paul, in practical terms, seems to have had an overdose of "learning" in youth, to have been unfortunate in love in about all the ways possible, and so fond of eating and drinking as to exacerbate his epileptic tendencies; so he messed up the Bible with cures for his own ailments, erroneously assuming that all humans had 'em. —— It seemed to be unnecessary in this book to give more than that general citation of the evidence that Paul asserted an erroneous dualism and ecclesiasticism which is the opposite of Christ's, and brief mention of evidence in other places that Paul's doctrine is in general wrong. I judge that such brief evidence will convince the good observer. But since I wrote that, an excellent book of detailed proof that Paul contradicted Christ has appeared:- I. Singer's "The Rival Philosophies of Jesus and Paul." A number of articles showing Paul's wrongness have appeared in the last twenty years.

c. The point of the last paragraph, from which we are to proceed, is that there is general agreement that the One is to be named Good, or God, or life, etc., and that we need pay no direct attention to whether we take a "material" or a "spiritual" name for that good. The reader may take his choice, and we shall obviously go along together; personally I have no preference in the matter so far as I can perceive, and without especially noticing which I am using, use both sorts. —— But that agreement that activity or life in general is good is a One statement. We must, to say anything definite about any part of that ineffable good, shift to science —use Many expression. The first *direct* truism is that as no unit of the many has any but arbitrary "existence" (and-or as the Many is formally opposite the One), then the Many is evil; or, we have the infinite pluralism, *Evils.....=Good.* We could just as truly write it *Goods.....=Evil.* But such a formally correct infinite pluralism is not consistent with our usual language agreements. We require an explicitly contrasted machine *That...×This...* (§100c), so that we shall not fall into materialism. So we may tentatively write:- *Evils...×Goods...=Good, or etc.* And that is the everyday form we use in asserting whether a *given thing* (any 'part,' whether an "idea" or a "thing") is *a* "good" or *a* "bad." So obviously, in our verbal practice the "opposition" between good and evil is merely language mechanics. It is also obvious that our language varies the Trinity form of the terms.

d. But that equation *Evils...×Goods...=Good* is of no particular use to us, as it definitely represents little more than our bare verbal mechanics:- our standards of dividing the Many into good and evil are only truistically implied by that equation. But it is *the* great human equation used by everybody, rather than the formal *That...×This...=Meaning.* And that ethical equation is equally a formal or verbal affair in which the *Evils...* and the *Goods...* obviously require definitions (standardized measurements) before they have particular meanings. Yet that obvious fact is usually overlooked by people (a point which explains much that is otherwise strange in history):- it is so vivid to those people that they mean *their* standards of measurements that usually those standards and the theory of them (the theory of periodicity in ethical terms) remain unstated and confused in their minds and their hearers'. The result is, of course, sooner or later a verbal squabble (polemics), which truistically is interminable so long as the need of explicit measures is not met.

e. Obviously, in no other way than by considering the experience of the race (and making more measures if needed) can the question of just what is right for a given man be settled fairly well:- the solution is to take ethics explicitly as a science, as definitely measurable as any science. That popular ethical equation shows the ethical solution of the One and Many; and with that we may stop using it.

§162. a. As existence or activity is truistically the ultimate good or happiness, and is historically so accepted, it follows as a further truism that the ultimate or greatest or absolute happiness is the knowledge or infinite perception that everything is connected together absolutely or organized or related together "personally" as the One or the universe. Obviously, that is in agreement with the ordinary ways of naming the greatest experienced happiness as:- ecstacy, ineffable joy or felicity or peace, rapture, etc., or a rebirth or religious experience (§153f): such happiness or general ethical good is "seeing God," or being God, etc.[162a] Also, it

[162a] The mildest evidence of a rebirth may be said to be a laugh —a sort of spilling over of nervous energy that has been set flowing by humor as a trigger. As we have casually seen from time to time, anything is humorous (witty, etc.: I am using *humorous* in a rough way) if it makes our perceptions of relationships spread out considerably wider (*usually*, also implicitly in a shorter time) than is usual. Thus the barbarian or the child finds it humorous to see the discomfiture of another person: it causes him to see that by his (the barbarian's) having a wider balance or relationship with the universe than he was conscious of having before he noticed the other's failure to have it, he avoids such discomfiture. If the barbarian sees a little more extensively he observes that the other's discomfiture is a failure

is a further truism that the object of life is to live. Further, the truism agrees with the usual intimate desire that God be a "person"—with the rather general idea that a person or any real God, or that true "spirit" or "soul," is "more" than the materialists' supposed arithmetical addition of hard, separate atom or thing to hard, separate atom; or the philosophers' arithmetical pantheism. Quite obviously, the ultimate truistic necessity of there being such a real One, or an actual *uni*verse, is that there be inseparable relationship. When that relationship is perceived, truistically it makes us see that we are not lonely, not unneeded, not separate and apart, but are joined inseparably to everything. In ethics that relationship or force is called *love*. So our rigorously ultimate ethical good is equivalent, to use the God the Holy Ghost part of the Trinity, to the usual conventional assertion that God is love. Finally, it agrees explicitly with Christ's One statement which he said was the "first and great" law (Matt. 22, 37):- "Thou shalt love the Lord thy God with all thy heart, and with all thy soul, and with all thy mind."

b. The last paragraph rigorously shows, by all the evidence of history, and with explicit logical consistency, that this book, in its destruction of agnosticism and establishment of a unified science, is in common phrase a means of giving "life more abundantly"—shows that religion in a real sense is synonymous with life. Further, the paragraph definitely proves that whether we *consciously* know it or not, we are ultimately God, and do love him absolutely—that being merely the conventional ethical way of saying that we *are* organically One. So I do not issue any "law" in the sense of a command, commandment, or fiat, handed down as by one in authority: I merely say that the facts, which may be readily verified by the reader, are to the effect that he does "love God" that way. —— *I* am no "authority" except in so far as I am comparatively an extremely minute part of the universe—one "fact." The whole universe, *all* the facts, is the authority, and it issues, *is*, principles that *are* obeyed —not principles that *may* be followed if a stiff-necked and weak-brained generation of fools fancies it will kindly condescend to obey them, paying for that stupidity by having about a half-life.

c. To express that infinite, ineffable good, happiness, or God positively, and 'apply' it with more or less definiteness to our personal lives, we divide it into parts or the Many (Part One). Probably the most usual everyday means of doing that are these two:- (1) We shift the One term Good or God (or any of its synonyms) to a Many or God the Son form and use the general equation *God the Sons...×Ourselves...= Good*. (2) We tacitly take it that human beings are the universe which is of primary importance to us (that they constitute our standard ethical universe), and use the human form *Neighbors...×Ourselves...=Good*.

d. That first equation, *God the Sons...×Ourselves...= Good, or God*, is often expanded so that *God the Sons...* is explicitly Christ, the Virgin Mary, the apostles, and all the saints and prophets. Clearly the equation is right, *provided* its circular, identical logic is understood and used—provided it is understood that Christ, and the saints, etc., are essentially the same as ourselves, and (on that side of the equation) are not One or perfect or "divine." Consistently, *God the Sons...* includes Carlyle's "heroes," our friends, etc. (see §166m). But obviously, often the equation is not used in that valid way:- at least four "deities" often are used as absolutely dualistic or essentially contrasted with ourselves. And just as aristocratic and dualistic as that, and patterned on such wrong usage, there conventionally follows substantially a *fixed* classification or caste of saints, prophets, popes, cardinals, archbishops, on down to the yellow dog—which last Christ, in his effort to dis-establish such aristocracy, too emphatically logically, but with perhaps justifiable emotional disgust over such stupidity, said would be first.

e. The second equation, *Neighbors...×Ourselves...= Good, or God*, is obviously a valid *That...×This...* in human terms. This total book proves its rationality. Also, as we shall see in detail as we proceed, it is obviously the formula for democracy; it is the formal and more accurate expression of the "Golden Rule," do unto others as you would that they do unto you; and it is the formal and more accurate expression of Christ's statement of the second great commandment on which, together with the first, "hangeth the whole law, and the prophets" (Matt. 22, 39-40):- "Thou shalt love thy neighbor as thyself." Christ stated that the two (see par. a for the first:- love God) are alike—as obviously by valid logic they are, one being the One assertion of the universe in ethical terms, and the other being the identical Many expression. Christ also asserted correctly that the Golden Rule was fundamental general law (Matt. 7, 12).[162e]

in perception of relationships that actually in a wider sense is his (the barbarian's) own failure (§47); and it then is not funny (neither is the barbarian longer a barbarian). But truistically, any comparatively quick perceiving of a wide fitness of things (which is often given by the observing of an apparently or superficially *contrasting* state of affairs, which we see we can overcome or change—of which we see the deeper unity) gives us a surge of nervous energy, a mild rebirth. That flood naturally irradiates to all the organs of the body, and when it is in mild enough measure it produces, apparently as a sort of summing of a speeding up or increased living of all parts of the body, various muscular rhythms that are laughter. It may produce weeping, but not often in a person unaccustomed to weeping. Or, if in greater measure it may more or less paralyze temporarily: it can, by variation in intensity, produce numerous sorts of biological phenomena—to the extent of trances, manias, etc. The universe may obviously be described in terms of humor—quantitatively extended from conventional measures into such increased ones. —— The danger that exists in being explicitly humorous is that jokes usually involve the use of some contrast to heighten the flood of perception of relationship, Many people fail to see that such a contrast *is* a contrast, and intended as one, unless it is carefully labeled "contrast" or "joke"—and the label truistically spoils the trigger action. So it is especially dangerous to put jokes in a scientific or other communication that purports to be usually straightforward rhetoric. There are no jokes in this book.

[162e] In my opinion the remainder of Christ's probable sayings indicate rather clearly that he (1) actually did distinguish the One and the Many, (2) had a general knowledge of the valid logic (e. g., when he shifts expression from the usual Many terms to a One form, he often indicates the shift by stating something to the effect that the saying is for those with "understanding"), and (3) as a general thing used the valid logic consistently, so that his definite recognition of the general ethical and religious law was based on competence and ability, and not upon a happy accident, so far as he was personally concerned, of largely subconscious cerebration. Many men hit upon and state correctly ultimate general principles: everyone's brain works out such all the time—it really being unavoidable. E.g., Luke (10, 27) puts the general ethical law in the mouth of a lawyer, and not in Christ's—presumably as having been distinguished from the trivialities in the Jewish law (Lev. 19, etc.) by the lawyer and people in general. And then the lawyer promptly asked Who is my neighbor?—showing that his stating of the fundamental law was accidental and parroting (or it raises a doubt as to the reliability of Luke's reporting). The able, competent man is the one who recognizes what he has done or said, asserts such recognition, and (unless by more facts convinced of a mistake and explicitly acknowledging such) thereafter consistently adheres to it. That last requirement is the one on which most of us fail; we usually have not the strong grasp on the truth which enables us to stick to it. It is easy to find the truth, but hard to "live" it, because in living it we must always avoid getting confused by the actually present infinite regress. —— So it appears definitely that Christ recognized the essential truth (cf. §159l), stated it correctly in a rough way, and probably managed to stick to it pretty well. And he did that in the face of dualism and autocracy on all sides of him (the pre-war militaristic Prussian was a meek lamb, with a gentle and gentlemanly Kultur, compared with the scoundrels in Christ's day); and he did it clearly enough to get

f. Obviously, in both those equations the extensive factor (*God the Sons...* in the first, and *Neighbors...* in the second) is in practice liable to be confused or misunderstood, although logically by our total argument both are equivalent simply to *Environment...*. We just saw that *God the Sons...* is grossly confused. And the ordinary meaning of *neighbor* is not definitely inclusive of environment. In fact, the lawyer asked Christ to define neighbor (footnote par. e), and Christ according to report responded with the parable of the Good Samaritan, which *as an answer* is (as it is written in Luke) irrational, irrelevant, and dualistic. (I. e., the parable shows that the Samaritan acted—perhaps exaggeratedly—as a man who is conscious of being a neighbor to the man who fell among thieves would act *in order to show* that consciousness—to be moral. That is obviously irrelevant to the question *Who* is my neighbor?; and the point is further confused by the details of the men who passed by; for obviously, in principle *they were neighbors*, which is the point, but were substantially asserted not to be.) The Bible is very full of such irrelevancies—logical evasions of the point. —— The same problem is in the even more ancient question:- Am I my brother's keeper? And it is nowhere *positively* answered in the Bible, so far as I can find, and is not fully answerable without explicit solution or the One and Many. So we may more precisely and intelligibly combine our two equations into this one:- *Environment...*×*Ourselves...*=*Good.* The equation then explicitly includes everything, and shows that atoms, etc., rigorously are "neighbors." The total evidence set forth by this book obviously goes to prove that the equation is valid: that all things *are* related to us (that we actually do love all things as being our neighbors—are *in some degree* our brother's keeper, even when that brother is an electron in another galaxy). That is a definite and inclusive answer, and proof of the answer, to all possible *questions of principle* in ethics. It remains to discuss some of the *quantitative* aspects of the equation.

g. A more convenient form of that explicit equation would obviously be one stated in more conventional ethical terms. Perhaps the simplest and most directly intelligible is this:- *Unselfishness...*×*Selfishness...*=*Good*; or, *Unselfish acts or phenomena...*×*Selfish acts or phenomena...*=*Good.* That equation obviously means that we are a machine reacting with the environment, and shows that primarily we should consider that the environment is attracting or related or loving, and that we *give* to it (are unselfish to it), so that it in turn *gives* to us so that we, still retaining *ourselves* as the point of view (the intensive factor), thus *get*, or are selfish. Obviously, selfishness and unselfishness are then merely points of view of the Many; *Selfishness...* is ourselves or the intensive factor; and *Unselfishness...*, the environment in general or the extensive factor. We *could* say that we and the environment are mutually repulsive, or opposed to each other with "force," or fight. Even then truistically each is transferring or *giving* something to the other (in physical terms, transferring secondary whirls); so in ordinary language we might as well call that giving a loving one.

h. The quickest proof of the validity of *Unselfishness...*×*Selfishness...*=*Good* seems to be this:- If we are absolutely selfish—are real Nietzschean supermen,—so that we totally separate ourselves from other things, obviously they can give us nothing; we would be in an absolute vacuum and would necessarily become zero ourselves. On the contrary, if we were absolutely unselfish—perfectly altruistic, as the extreme socialists and the I.W.W. and Tolstoy and parlor intellectuals in general theory seem to pretend to be,—then obviously we would totally give away all we had, including ourselves, and would become zero, or absolutely go out of existence—another impossibility. Clearly, the *Many* statement of selfishness and unselfishness is like that of all other machines or *That...*×*This...*'s of the universe:- both Many parts must remain finite, and the sum total will actually be a perfect balance of the two (which two spread out to include ultimately the whole universe). So that balanced reaction must consciously be striven for (it ultimately exists, whether we are alive enough to be conscious of it or not, as shown in §114c: the profiteer who tries to grab something without giving adequate return pays for it by having his brain die some). It is the same solution seen repeatedly heretofore. For an excellent statement in detail (and with no obtrusion of technical logic) of how selfishness and unselfishness should be balanced, see Lee's "The Lost Art of Reading" and "Crowds." A definite application of the principle to actual industry or everyday living or "economics" is made by Taylor under the name "scientific management" (§168j, etc.).

i. Christ's Many statement of that ethical solution (and a number of men anticipated him in making it) is:- do unto others as you would that they do unto you; or, love your neighbor as yourself. Clearly, that is *vaguely* a statement of *Unselfishness...*×*Selfishness...*. But equally clearly, if it is a Many or quantitative statement, definitely interpreted as such it is not true—is illogical. I. e., Christ's form of statement *verbally tacitly assumes* that you and your neighbor are *quantitatively equal*, and *such is never the case.* Practically, if I loved one neighbor as much as I loved myself, I quite obviously would not have much love left to lavish on neighbor number two—for love is definitely chemical affinity and gravity, and as a Many individual I have a certain limited quantity of it. (Of course it is unlimited, if I lapse into mystic, One expression: but we are speaking scientifically, or *in everyday quantitative terms.*) Or, if I *definitely* treated a baby in the way I wanted the baby to treat me, obviously he would have cause for grave complaint. In short, the conventional quantitative statements of the ethical equation are only rough implications—they are glaringly wrong if taken explicitly. The reader may say that they are *intelligible*—that we understand what is meant by them. I agree that if we are not in the defective upper ten or submerged tenth (who usually do their grabbing under a verbal aegis or bluff of the Golden Rule), in ordinary routine circumstances we know pretty well what we ought to *do*; and when we do it we are likely to say that the doing did agree with the orthodox rules. But those rules are obviously such an uncertain mixture of One expression in a Many guise that we are practically nearly without any valid quantitative ethical theory. But of course much of valid existing economics and allied subjects are actually ethical and serve in the place of the direct ethical rules that the theologians have failed to supply although it was their duty to do so: e. g., Taylor's principles of management are a precise and workable statement of those defective and

his solution stated fairly well by dualistic reporters who had but little knowledge of what they were really saying. So it seems reasonable to regard Christ as an unusually great genius—or saint, or prophet, if you prefer those terms. But that is a quantitative judgment, and is merely my personal opinion, for which I have given considerable evidence; there is much in the Bible that is explicitly attributed to Christ which is grossly wrong both quantitatively and qualitatively; and it is not possible to find out absolutely what he did teach, as it is a quantitative question. So if you consider that Christ was about as wrong as right, then I have to agree that possibly it is so; if we take the Bible literally, as many theologians say we must, then I have to agree that assuredly you are right. *But*, it is unessential whether we regard Christ as an extraordinarily fine man or not: it is rigorously proved that he is essentially the same as any other unit of the Many, and his quantitative size is unessential *as a matter of principle.* As a matter of practical living, we ought to be able to estimate him quantitatively, as will implicitly appear.

missing ethics. As a One proposition all men are equal, because each man ultimately is God. But when we react together as skin-bounded men we are by no means equal, and can not possibly work by a rule which tacitly asserts such non-existent Many equality—as the Golden Rule and its usual theological and grafting (e. g., socialistic or "red") interpretations do. E. g., even the coarse statute or lawyers' law does nothing else but define and handle individual inequalities. A murderer is treated by it quantitatively differently from a minor, and a murderer has effectually asked, by his deeds, for such quantitatively different treatment. Sound law does nothing else but divide people into classes depending on their *actual* 'size,' as measured by their acts, etc.; the unsound law to which we object as being "class" legislation unnaturally and never really successfully tries to divide men into *fixed*, constant, exact-science classes, instead of recognizing that men are unequal and are continually by their own acts and merits fixing their *varying* classes (XIX).

j. So Christ's Many law or Golden Rule is inaccurate, although as a rough general approximation it probably was needed as a first step in democracy (or perhaps it is more precise to say that the One implication the law correctly gives was first needed). The more accurate law might merely have confused men in that crude age. But now we have better nervous systems, and can go beyond that child's step in democracy—i. e., perhaps the majority have strong enough nervous systems. So we shall explicitly consider our equation or law quantitatively, and get the statements of what we ought to do, expressed in terms of what we actually do do. For we saw in the last paragraph that we do not follow the inaccurate Golden Rule. By thus becoming conscious of what we do, we very perceptibly get a more abundant life, and can also anticipate the future somewhat—make statesmanship a science, instead of having it as in well known history, a sort of black art that rarely works, and so partly in pursuance of an instinctive sense of decency that make people hide defects and shortcomings from the pained gaze of others, conducted as much as possible in secrecy.

§163. a. We have seen (§160b) that within certain narrow limits of reaction of *Environment...*×*Ourselves...*=*Unselfishness...*×*Selfishness...*=*Good, or Energy* the quantitative summation or standard universe of *Good* or *Energy* is so little perceptible to us as to be considered morally indifferent, or unmoral. I. e., a perfect or nearly perfect balance or morality is not directly perceptible to us (see par. b). A consideration of that fact shows why what we call "happiness," or a fair balance in life, is so elusive, and why there are so many conflicting opinions as to what it is and how to get it, and why as a usual thing if we deliberately and consciously "seek" for happiness the very seeking is an unbalance that causes us to fail to get happiness or a fair balance. Obviously, in our daily small acts with the environment (whether they be "spiritual" or "idealistic" acts with our fellows, or even "spiritual" reactions of parts of our own selves or nervous systems; or "material" or "utilitarian" acts with "things," such as wearing clothes or eating), a single act is usually not accompanied by any perceptible pleasure or pain —to us the act is simply unmoral. But evidently each of those acts actually does tend (1) in a direction towards a vital or moral or "good" balance, or else (2) away from it. And if those acts, instead of being temperately rhythmic (first in one direction and then in the other), tend steadily to accumulate in one direction (either in the direction of zero activity or doing nothing, an intemperate parasitism; or in the direction of infinite activity, an intemperate hurry, mania, radicalism, fanaticism, etc.), then it is evident by simple arithmetic that we shall run into a painful unbalance, and as a truism achieve unhappiness. —— Those unmoral acts are the "little things" or "trifles," and in many lives sum up arithmetically to more than the "big" things, and so have the greater effect on happiness. A man moral in the big, perceptible things can readily accumulate great unhappiness by being *in sum* very immoral in unmoral things. And many men who are noticeable scoundrels in some big things have kept themselves well balanced in the unmoral or little things and so have been on the whole rather happy—in spite of the fact that the big immoralities inevitably subtract something from their sum of possible happiness. Truistically the unmoral things are not perceptibly indifferently moral *in sum*: each one is a dot in *Emotions...*. But if a man "seeks" happiness, he in practical effect magnifies each of those unmoral acts into perceptibility, and thus becomes a sort of experimental laboratory of morality instead of a live person: he takes out the wheels to see what makes life go 'round, and it truistically largely stops going, and the world correctly labels him over-conscientious, pious, a neurasthenic, a prig. He does not gain happiness, but often imagines that he has committed the unforgivable sin (the dualistic, fancied "absolute zero" in ethics). —— The truistic remedy again is temperance. Instead of nearly totally neglecting the unmoral acts, or of trying to force each to a perceptible morality, we take a middle course of letting them accumulate for a while (a week, a month, ten years—it is a quantitative problem, and primarily needs good judgment by each person for himself), and then take out the wheels temporarily and examine them, and correct tendencies as may be necessary. It is not likely to hurt anyone much to go to (say) a dance once: but a hundred times might. —— So obviously there is no mystery about getting happiness, nor any injustice in its bestowal. The rain does fall alike on the just and the unjust. But there is the additional fact that the unjust in the long run never have sense enough to take advantage of the opportunities thus afforded: they merely complain of the weather.

b. We saw further (§160b) that beyond the amounts of *Energy* or *Good* which are unmoral, there is a range or zone or spectrum of amounts in which the acts are perceptibly pleasant or right or moral. Beyond that is a doubtful zone; then an immoral zone; then an unlimited zone of destructive but imperceptible immorality in which the individual is killed as such—changes to whirls of a different order. I may most clearly show those zones, with their limits, on a rectangular hyperbola, analogous to the hyperbola used in Fig. 104b to show the forms of *That...*×*This...*=*Energy*. This humanistic naming of the parts of the hyperbola serves to make that more general equation clearer. —— We have the equation *Unselfishness...*×*Selfishness...*=*Good, or Energy*. Let the axes of Fig. 163b (see next page) show the two factors as indicated. The points of *perfect* balancing of all structures are on a line at 45° to the axes—one point being at O as shown, this point being for a given Many man (compare that with the physics statement of balance, §114c). The rectangular hyperbola through O is for the equation *Unselfishness*×*Selfishness*=*Energy* (a *constant* standard universe)—a *perfect* equation (no dots or regress). Truistically, the man will be in a rigorous monistic Nirvana if he stays on that perfect hyperbola at O. In a Many existence, a slight departure from the balance destroys some of the man and makes some other part grow, the change being a decrease of (say) extensive factor and an increase of intensive—the unbalance not being great enough to cause a general change to some other order of structure. I. e., if there is too violent or extensive a change in some part of the man, other parts can not perform an equally reacting change, and the man dies. So we can take it as being a *rough* approximation that so long as the

man remains organically a man he oscillates back and forth from O on a curve which *on an average* may be represented by the hyperbola from D to D′. Beyond that, on the dotted portions, the man as a whole structure changes definitely and

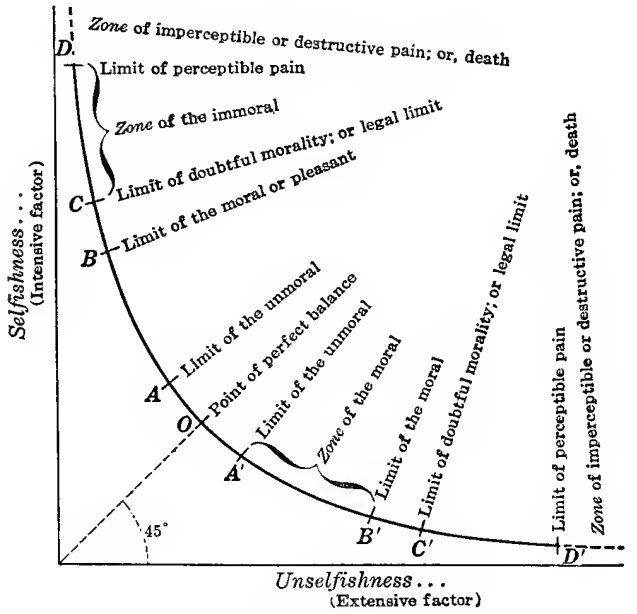


Fig. 163b.

perceptibly to other orders of whirls that can no longer be represented by this average curve of one organism or order.

c. We take it that the man in his swings from O to either A or A′ can not consciously perceive the departure from O; so A and A′ are the limits of the unmoral—A being the selfish or intensive limit, and A′ the unselfish or extensive limit. (Hereafter without further statement, the prime letters are extensive limits, and others intensive limits—and analogously with *zones*.) Then, so long as the man oscillates inside A and A′ he is in the *zone* of the unmoral. In those oscillations truistically some structures in his body are being broken down and others built up—but imperceptibly directly to him. So he continues to exist 'averagedly' or as one man on (represented by) the perfect curve; but some parts of him move off the curve and perform cycles. And obviously, those cycles of small, imperceptible quantities of energy or structural changes in *time* sum to a perceptible quantity, which, if in moderate amount, is perceptible and moral and gives happiness. But if most of his departures from the balance O are in the same direction, then parts of his body truistically are being continually worn out without being substantially regrown (and possibly other structures increased), so that the accumulation finally runs past the limits of morality and happiness—finally into death. We all finally wear ourselves out by being unable to keep moral acts accurately cyclic.

d. From (say) A to B our acts become directly perceptible, and easily within the limits our unit man-structure tolerates (cyclically substantially re-grows), and are moral or pleasant or happy (subject to the possible accumulations with time, par. c). —— So truistically our acts in the A to B or moral zone stay fairly well within the tolerable limits of *another* man, assuming that he is quantitatively of about the same strength as ourselves, which roughly in most cases he is. But it is obvious that structures of different order must have curves different from the curve for men (i. e., atoms or birds couldn't enjoy and thrive on what we do); and those 'different' curves obviously can not be directly compared, but can be by means of the inverse square law, just as temperatures of different order structures may be—that showing that quantitative ethics is theoretically unified with all other sciences (and incidentally, also that *our* ethics are identical with those of birds and animals when properly translated). Further, it is obvious that by the theory of incommensurability the extensive limits and the intensive limits can not be at the same distance from O, although they are roughly shown so in the figure. Also, of course A and B (and the other limits, etc.) are only approximate for a given man during some comparatively short period of time. The man is always changing—and obviously the limits, etc., are glaringly never sharp and definite anyway. —— All that is a brief indication of quantitative ethics—which is explicitly identical with the other sciences we have seen, and clearly not exact.

e. Then from B to C is a zone which is so intense (or so extensive) that it is a *doubtful* zone: we do not know whether it is pleasant or painful. E. g., we enjoy one hearty laugh, even though it feels a little too hearty; but two in close succession (before we have time for re-growth) are likely to be painful and immoral. We have to gamble a bit in this world, there being no exact science; and ethically we gamble by getting into this doubtful moral zone *occasionally—and with courageous abandon when we do* (§§149e, 159, footnote par. h).

f. The doubtful moral zone BC (and B′C′) might rather consistently be called the zone of *legal morality*. I. e., lawyer's law usually undertakes to designate the limit C of doubtful morality as being the permissible legal limit. Such law recognizes that this limit is different for different persons; but it recognizes it only in a rough way as beween minors and adults, as to some differences of man and woman, and as between some conditions of health and disease. Obviously, every man has a particular personal limit C. —— As a general rule, the poorer (according to customary judgment) a man's brain and-or body is, the lower (closer to O) his pain endurance *for one given act* is; or vice versa, the "highly strung" or better trained man can stand much more of one act. —— Theoretically the statute law should make distinction as to the actual inequalities of men in infinite regress: practically the law correctly does so as far as the majority perceptions go. Perhaps the next practical step in the law will be the majority recognition that aristocrats (whether in the "upper" direction such as kaisers, dualistic theologians, and financial pirates, or in the other direction of shirking, irresponsible, socialistic workmen) are mentally defective, and must in some respects be treated as minors (held irresponsible for most contracts, promises, etc.). Those people are instinctively always asking for such privileges; we see that their instinct agrees with the facts about them, and should not be completely thwarted (as is implicitly shown by XIX). But they in turn truistically should be explicitly deprived of the adult rights that go with adult responsibilities. E. g., in many places a labor union can not be effectively held to a contract; if they do not want to be, then the obvious solution is to make them legally incompetent to bargain—including authorized procedure by which they can leave such a status whenever they feel disposed to put away such childishness.

g. It follows as a truism that when any man considers himself moral, or humanly justified, in *continuing* to react with others quite out to the limit C permitted him by the lawyers' law, then he is badly wrong. The man who says "business is business," and means by that phrase that he will strive to take everything the law allows him before jailing him, and the lawyer who aids him in that sort of business, theoretically hold the pre-war Kultur which demanded a continual striving away from the balance—an absolutely wrong view. None of them in practice make such absolute scoundrels of themselves: they automatically act better than they profess to. Obviously, if a man thus tries to keep

acting in the zone of doubtful morality he rather quickly accumulates an immoral unbalance that damages both himself and others. Generally speaking *he damages himself considerably more than any other one person*; for obviously his activities are usually spread over many others, but the reaction is concentrated on himself. If he and his accomplices, the lawyers, can stand that reaction, and also stand the knowledge that we see that they are fundamentally wrong morally and hence undesirable citizens and neighbors—if they can pay that high price, I think we can tolerate the damage they do us without trying to fight them with their own fire, the statute law, which they have in their pseudo theory spoiled (§173), and have somewhat spoiled in practice. If financial pirates and their "business is business" lawyer-accomplices had enough intelligence to understand the high price they pay in personal deterioration for that profiteering (and profiteering is an attitude of mind—a desire to get all that can be grabbed—rather than the actual amount that is got), they would automatically stop it. So the best way for us to eliminate such legally permitted grabbing is to show the self-deceived grabbers what they pay "out of their skins." —— It is probably a fact generally recognized, even by lawyers themselves, that the average lawyer considers it entirely moral and in every way right for everybody, including himself, to act continually up to the limit explicitly forbidden by lawyers' law. This paragraph rigorously proves that to the extent which that notorious fact applies, the legal profession are morally and mentally inferior. In my opinion the fact applies to a large majority of lawyers. But of course the legal profession contains some very able and honest men: Lincoln was such an exception. And the leading lawyers seem to have a surprisingly contemptuous opinion of most of their colleagues: e. g., Storey ("Reform of Legal Procedure," 3, 5, 6) approvingly quotes able lawyers:- Taft:- "The administration of criminal law in this country is a disgrace to our civilization"; Vance:- "The American lawyer has proved a failure"; "The legal profession in America is blighted by serious faults. The first is a low moral tone, manifesting itself, in its worst form, in deliberate preying on the public. *** The second is a lack of the knowledge of the law as a science, as distinguished from a knowledge of the law as a craft." For the *legal* theory of what is wrong with lawyers see §173.

h. The remarks in the last two paragraphs about the *direction* in which we act may be generalized:- Clearly, if we continually strive to go away from the balance O, we are striving to accumulate an unbalance. If we keep on trying to grab more and more things for ourselves (go out continually towards the asymptote on the *Selfishness...* branch) we are trying to make unselfishness zero, and will inevitably blow up (get irretrivably out of balance, and change order of structure; in business terms, "fail" unless we go to pieces physically first and die or have to "retire"). And precisely the same result occurs if we try to keep going in the other direction—try to be too altruistic. As a general scientific fact, we have seen that any given structure, so long as it remains substantially itself, always tends to oscillate back to a balance (§114c). Therefore, unless there are valid conscious reasons why we should seek death (as may sometimes be the case—truistically, as it is quantitative), we ethically should *try* to pull ourselves and others back to a balance together; we should not (using ordinary language agreements) try to repulse people steadily, or use "force" or "might" or (in the latest weaselly euphemism) "direct action" on them, or "drive" them; but we should love them, or like them or cooperate with them, or work *with* them—those phrases indicating the reciprocating give and take or rhythmic cycles that give balance. Kultur, or "blood and iron," words, by ordinary verbal agreements, assert or imply that we are *trying* to create an unbalance—be superior, "better," aristocrats (except of course parlor radicals and Nietzsche use them to make-believe that they are brave, fierce, wild creatures). And obviously, to assert that we try to create more unbalance is to assert a fundamentally wrong principle—actually it is a stupid assertion that we are seeking death and destruction. And as we shall see (§169d)—and this is the point those repetitions are driving at:- such a wrong *principle* is *intolerable*. We will not and can not and never do tolerate such wrongness in principle, regardless of what we may carelessly and ignorantly *say* about it. All this is obviously identical in principle with the theory of genius (§159), and need not be further expanded. —— We saw an example of the practical attempt at such a wrong principle by the people who consider it even permissible to go continuously as far as the law allows. Precisely the same stupidity is exhibited in the various "public be damned" attitudes. The railroads found by direct experiment that it did not pay; now most railroad officials are so imbued with such ultimate human wisdom (expressed in common terms:- it pays to be polite, to avoid friction, to be pleasant, to smile, not to get into any fight that can be avoided [and all which do not *directly* involve principle should be: §169d]) that they are our best men. Some labor leaders seem to have adopted the "public be damned" policy. They will get their experimental wisdom to the contrary rather more violently and painfully than have others, because as a usual thing a labor leader's mind is very poor. —— Precisely the same error inheres in all "class wars," or in the idea that labor and capital are *conflicting* rather than merely *interacting*. As a matter of fact, as a rule in this country the successful business men (excluding numbers of momentarily "successful" money-grabbers, brokers, and others whose alleged services consist mostly of price gambling[163h]) very clearly recognize the truth of that

[163h] *Gambling* is an economic and an ethical and psychological loss to everyone who in any given gamble is not with definite consciousness engaged directly in it, and who thus has not the gambler's selfish satisfaction in obtaining the quantitative answer concerning which the wager is made at once or quickly (the gambler arbitrarily increases the importance of that answer in most cases by a money stake larger than would be needed otherwise). For economic proof, see Marshall's "Economics," (135, 843); to make that proof rigorous and also extend it to ethics and psychology, apply it to the Weber-Fechner law as given in §156. It therefore rigorously follows (see more familiar proof given below in this footnote) that the gamblers (including all business price-gamblers) get a selfish satisfaction (not recognized by Marshall) at the expense of other people. It is precisely the same as the obvious fact that the man who does not know has to risk himself, and also in some degree the comfort of other people, in finding out. And usually the price-gambler keeps stretching his own perceptions into the doubtful zone, so that his pleasure turns into pain and immorality—which is some part of the cause of the high death rate of stockbrokers and similar gamblers. —— Fundamentally, to give the proof of the wrongness of gambling in more familiar terms, gambling in the widest sense is our guessing at quantities, which is forced upon us by the principle that there is no exact science. In that wide and very usual conventional meaning, we can do nothing in practical life but gamble. But in a narrower sense, gambling consists of making it of greater importance to guess than is ordinarily necessary. The gambler increases his stakes in order to make his guess at a quantitative result of more importance or perceptibility to himself; and obviously that consists in trying to make activities depart from their normal balance (*except* in the possible case where the gambler needs the psychological stimulus and can and will substantially restore the disturbed balance). The gambling forced upon us by 'no exact science' is usually an attempt to go towards the balance, and then in temperate quantities is moral (e. g., when I started to work out this book one expert adviser said I was immorally gambling with my sanity). Obviously, the well recognized difficulty in deciding as to the morality or desirability of gambling is due to the fact that we have to decide whether a given *act* (*not* intention: all intentions from the point of view of the holder

ethical principle and apply it to the best of their ability. Their chief difficulties in applying it consist some in the opposition of the little ignorant, mildly incompetent business men, but mostly in the opposition of the class-conscious, output-limiting sort of labor, who still are ignorantly inclined to "fight" and who have not enough mental integrity to keep their contracts (to say $A=A$ and stick to it).

i. At the limit of doubtful or legal morality (say C, Fig. 163b), the perceptions of given acts become painful, and increase until at D we pass beyond the limit of perceptible pain into the zone of imperceptible pain (into unconsciousness or death), in which zone the unit personal structure changes to structures of different orders, and the man ceases to be an individual man. If we pass beyond D into the zone of unconsciousness the system may recuperate and after a time re-unify and return to consciousness. Almost daily the accumulation of unmoral acts forces us into the zone beyond D, where we are unconscious in sleep. When we undergo that phenomenon usually there are enough reserve parts (perhaps nerve cells) to permit us, as unit individuals, to pass through the zone of pain CD so rapidly as to make it imperceptible. —— When we are in the zone of perceptible pain CD we are obviously being automatically warned by nature to get back to a balance (as a truism, or mechanical automatism, that departure from the normal *is* pain); and we usually heed that warning. So truistically pain or suffering in this Many sense is not a One evil at all, but a positive good that saves us (for by verbal agreement, to be saved, to exist, is good). Further, the next perceptible step on the outward swing from the balance is Many unconsciousness; and obviously that is not Evil either, but is usually merely a means of automatically stopping us as unit individuals in our swing out, so that we may have a chance to recuperate. But sooner or later we swing into the unconscious zone and can not recover as personal individuals, but *as such* are permanently unconscious or "dead." But we see again that this is merely a little wider cycle than any before, and not essentially different from the others. In no case was one of those cycles a perfect cycle; i. e., in no case did we ever, at any step of the actually infinite regress along the curve, come back exactly to our previous personality.

j. We have seen that the whole individual does not actually stay on the perfect hyperbola. This curve is merely the average—a general way of showing the principles. What actually happens is that there are *parts* of the individual organism which are in periodicity with the whole organism (or 'galaxy'), and those parts build up and break down to some degree without definitely changing the unit organism (just as do the parts of the stellar galaxy). We may say that the 'smallest part' remains such in the unmoral zone (for a time: I omit explicit discussion of the T's), but at about the limits A, A′ changes into structures of different order—perhaps joins on as a part of a larger structure; perhaps break up into debris: no one yet definitely knows those quantitative details. Then the next 'heavier' or 'higher' structure survives inside the moral limits B, B′. And so on. The equation for those parts is $M(varying\ with)L^2T^{-2}=Energy$. That 'smallest part' which survives in the unmoral zone is a standard universe *Energy* or *Unmoral emotion*; then there is a "larger" standard universe *Consciousness*; etc. M truistically can be an ethical unit (cf. §158)—whether an "act of love" or a "square meal" being immaterial to the theory, but of primary importance in practical measuring—in determining the selection, naming, and evaluating of ethical coefficients. The quantitative theory of ethics is as nebulous as electricity was three centuries ago; hence, I have too little definite quantitative experience to make a competent suggestion as to what *sort* of ethical units should be used; but a tentative guess is that if ethics is to be a fairly definite branch of science it will occupy the ground between psychology and economics, with units of money and human effort (cf. §§168b, 172b for equational statement of that). F. W. Taylor's scientific management was the first rather definite work that substantially made ethics a science, taking it out of its previous status of theoretical mushy "idealism" and practical exploiting. Taylor was therefore a pioneer of the size of Christ, Newton, Darwin. His work is now being extended in a practical way, usually under the name of management engineering, by such leaders as Cooke, Thompson, Hathaway, the Gilbreths. In a theoretical way his work is being extended under so many names in the colleges as to make it seem that the name *ethics* may not survive the odium of its theological misuse. —— That equation in ethics therefore has the same theory of periodicity as in any other science (cf. §158 in psychology; for ethics the structures are of different size). And the mathematical discussion of those zones and limits (which constitutes some of the definite details of 'periodicity') is obviously identical with the economic theory of marginal values, etc. (which is simply a general discussion of our daily problem Is it worth quite that much to me?). A "marginal value" is above called a 'zone,' etc. (see Marshall's "Economics"). —— So all of science is again seen to be rigorously unified and we now see in the most familiar detail that it is not necessary, for a complete understanding of the variations of *any* thing, that the conventional "measures" be made. In short, it is possible to state the *principles* of all science a priori. It could not be *strictly* a priori: it would actually be the conclusions from watching our own nerve cells act; but that is usually called a priori, although there obviously is no essential experimental difference between watching one of our nerve cells work and watching the galaxy work. However, the man who restricted himself to watching one of his nerve cells act would almost certainly be so excessively poor in practical judgment (in sense of proportion, or ability to guess well at the proportions of phenomena in general—"sense of proportion" is the common name for 'periodicity,' and as artists admit they ought to have it, some may be distressed to hear that it means not only practical, but "worse":- scientific) that his observations would be practically worthless—which shows why any man who specializes too much has poor judgment and is poor as an executive. —— Several volumes of expansion of those facts must be omitted at this point (the rhetoric has already passed the point of condensation that is tolerable)—such as showing that the solution of the One and Many proves that a priori and a posteriori are ultimately identical—which is the same as saying that valid logic uses "deductive" reasoning and "inductive" reasoning simultaneously and hence without ultimate distinction.

§164. a. The last section gives in a rough elementary way the quantitative establishment of ethics as a science. We are now ready to consider some of its general principles and applications.

are good, as we have seen) tends toward a balance, or an unbalance. The gambler who disturbs any equilibrium, hoping to grab some profit for himself in the resulting confusion and uncertainty, is immoral in cases where he can not demonstrate an increased balance for others, or where he does not restore the particular unbalance he causes—or even try to. The gambler who proposes to make a business of—keep on—making such unbalances is himself extremely immoral, but may perhaps be morally permitted to spoil himself if he wants to, in order to give normal people occasional moral gambles. In this matter we run into the quantitative regress practically, and can't be certain whether stockbrokers are moral or not. With a steady climate, it is likely that in a few years we shall develop enough not to need such "artificially" violent activity as price gambling, and then the present-day broker will be immoral.

b. As ethical good or happiness is activity or life, it follows that the basic ethical or human aim is to *get all of it that is quantitatively compatible with various Many aims or purposes or relationships*—in short, have a sense of proportion or periodicity in "living" (a direct truism). The active achievement of that is virtue, righteousness, merit, morality, etc.; and the failure to achieve such fair quantitative balance is sin, iniquity, ungodliness, wickedness, etc. For as seen, if we swing too far from the balance and get *too much* of what otherwise is "life," the pleasure quantitatively reverses into pain or immorality, and some structural part reverses or "dies" and we actually get less life. So the prime ethical aim is to build up a biological structure (chiefly the nervous system) that is more extensive and intensive, so that it will survive greater excursions from the balance—for otherwise much of a swing, much "prosperity," hurts instead of pleasing (truistically, "*too much prosperity*" *hurts*). We have seen that such a strengthened individual is usually called a genius. And such increase of quantitative tolerance by many men is called progress, or increase of civilization. Or, in physical terms, the nervous system is more differentiated (the quantitative details are as yet unmeasured), so that slight parts of it reverse when we experience numerous phenomena, or dots in our formula—which thus makes the formula or "life" pleasurably perceptible a long way out. —— And all that is a definite, truistic, intelligible way of saying that the prime ethical aim is included in what is usually called *education*—a life-long process of extending or leading out the nervous system to grasp and tolerate more life, including of course truistically the "application" of what is grasped—a process of grasping skill or art, *and* the use of that skill or art. (Conventionally, "education" often tends to mean verbally only a taking in of stimuli; but as a truism the cycle must be completed by an equally proper discharge of them, as "doing" things, or the application of such half-education.) And equally obviously, that education requires the education of the moral man's neighbor. For if his neighbor is not able to make as wide excursions as he can, then he is not able to react (live) with his neighbor without hurting the neighbor and in the reaction hurting himself. In short, if you get ahead of your age you pain yourself as much as you do your neighbors, and more than you pain any one neighbor. There are two quantitative modifications of that:- (1) if you are more widely educated than your neighbor, you can keep away from him somewhat, and react directly with "material" things—invent something, make things, "enjoy nature," etc.,—a theoretically rather unsatisfactory sort of procedure, in that it is not direct reaction with the same order of whirls:- men; (2) and you can distribute your reactions among many people, so that no one of them is much pained; but that is also truistically unsatisfactory, in that they can not react equally hard and make it interesting (just as an expert ball pitcher would not care to pitch to a girl). So if you see anyone priding himself on knowing more than his neighbors (so that incidentally he ought to act as a sort of superior spokesman or Woodrow Wilson for them), you can correctly conclude at once that he is wrong about it, and probably knows much less. If he actually knew appreciably more it would be a misfortune to him, and he would say that it was a misfortune, instead of being puffed up.

c. So truistically the basic sin is ignorance or stupidity; for ignorance is a narrowing of life. And obviously, sin is an unessential quantitative matter (in its ordinary meaning). All of us soon reach the point where we can not perceive further, and where we have to stay ignorant. Our intentions are always good, and thus there can be no One sin—no unforgivable sin. But there is, as we saw, a species of stupid person who substantially asserts that he wants to be continually trying to depart from the balance. Formally or logically he is guilty of One or absolute sin; but of course he in practice does not do it—merely is stupid in high degree.

d. So the basic practical or quantitative rule of ethical procedure is truistically (1) that we must try to make our perceptions of life a little wider, but that we must not do it more often or vigorously than will allow us each time to get a cycle of rest by going in the opposite direction; and (2) that while we are doing it we must see to it that we do not make our neighbor react unduly far, so as to pain him much (provided he is fairly normal or right). That is obviously identical with the psychological rule for being a genius (§159), or the biological rule for living a healthy life (§149e), *with the addition* that now we are *explicit* about considering the effect on our neighbor. (Of course in the two former rules our neighbor is implicit in *Environment*... .) —— And that ethical rule is obviously identical with the *conventional fundamental law of life:- the law of self-preservation.* Clearly, that law tacitly assumes that life is worth living—that good is activity or life. And the law includes the principle that while we are *cyclically* stretching our lives we will be equally careful to preserve our neighbor's life so as to obviate his too large reaction in ours. Or it may be said that I have merely verbally expanded the ordinary moral law (the one that gives the "right" of self-preservation), by asserting the principle of the so-called "sanctity of human life." The expansion makes the law intelligible, and proves it, by showing the truisms upon which it rests—and shows that the total argument of this book is in accord with the fundamental judgment of the race. —— It then becomes evident that the "right" of self-preservation and the "sanctity of human life" are-is not One or absolute. As is obviously the fact, and as we now see is correct in principle, in Many practice or living the right and the sanctity is accorded to others only in the measure in which they in practice accord it to us. The principle is that we give to others the sanctity of their lives just as far as we can—*giving them the benefit of any doubt* because we recognize their ultimate Oneness and identity with us. That law, thus fully expressed, is conventionally called the "*law of humanity.*" Obviously, when the Germans in sinking various ships acted on what they called military necessity, or upon any other similar tacit assertion that their own lives were essentially superior in value, they violated that fundamental ethical law or law of humanity, and in the most vivid practical way (i. e., by deeds) showed in that case at least that they were unable to grasp fundamental principles. Yet, by the *conventional* theory of lawyers' law (which theory is wrong), the Germans were legally right (cf. §173) just as they contended; Wilson, by equating the law of humanity and legal law, did poorer thinking than the Germans.

e. That basic ethical rule, the law of humanity, is obviously merely a fairly definite quantitative statement of love for our neighbors. It also can be seen to be inclusive of the more or less synonymous virtues of *duty, reliability, service, kindness, cooperation, responsibility, loyalty, toleration, faithfulness, politeness, cordiality, interest* and *ardor*, etc. There are numerous ethical names for that controlled, and temperate, and balance-seeking or loving, human interaction with the environment and-or other humans, which action yet strives to grow as large as it may, having due regard for conditions. Those various names designate various combinations of reacting parts as being given in certain conditions. Truistically, our statement of the principles refers to all combinations and conditions, and hence covers the principles of those virtues. —— But we saw (par. d, (1), (2)) that in following the basic rule we always have an intensive factor and an extensive

factor. So we need to consider the character of our conduct when emphasizing (1) one factor, and then (2) the other. Truistically, each cycle of conduct consists of emphasis on one factor, and then reversal onto the other—of unselfishness and then resting selfishly; of working and then having its pay get us work from others. Any definite and applicable knowledge of ethics requires explicit grasp of the character of such cycles, which is given in the next four sections.

§165. a. Fundamentally, the intensive or personal factor in *Unselfishness...*×*Selfishness...* emphasizes *T*, and the extensive or environmental factor emphasizes *L*. We shall definitely consider the gaining of the greatest happiness from those two points of view of *T* and *L*. That gives principles which we all know and use, but which we have been taking as commonsense, rather than lofty "ethics."

b. As a truism, if there is some activity, some part of the universe, for us to become conscious of, then the less time *T* we use in becoming conscious of it—"living" it—the more we live, provided we do not damage ourselves (and others) so that we can not then use the time saved to live more. In short, one aspect of the fundamental ethical principle is, that *other things being about equal* the faster we can and do live the better we are. So *economy of time* is moral, and waste of time is immoral. —— That does not require "hurrying"; it means being *conscious of living* as much as we are grown able to be, pleasurably, in a given time—rather than being chiefly *conscious of a clock* or some equivalent during that time, which is what hurrying, or being *consciously "efficient,"* is. The human aim of science for centuries has been economy of time—to state that aim from one aspect (the complete aim is the conscious use of energy, life more abundantly, which includes both *L* and *T* explicitly). —— Probably nearly everyone knows all that. But as it is not particularly recognized by the Oriental ethics of the Bible we are not accustomed to seeing it expressed. The following is obviously the way it happened that the Bible and Christ substantially overlooked and omitted explicitly expressing "half" of ethics, so that it remained for future generations to add that half or *T* aspect as "science":- We see vividly that our own consciousness emphasizes *T*; but there is more difficulty in being conscious of "objective" things, or of emphasizing *L*. So Christ and other Orientals (and this is the only general way in which Christ is not mentally an Occidental), took for granted as obvious the *T* aspect, and spent their efforts in seeing and talking about the space extension of man (unified by the relationship of love) finally into God. It is an example of make believe. —— The result was that the universe itself or God automatically corrected that omission of a definite *T* by shoving us along into a clearer view of the morality of the economy of time—we gradually learning to use time better and better. So if we take the novel view, but nevertheless in fact the practically true one, that theology or the ethics of the Bible (apart from its incidental dualism due mostly to Paul, which the race in general never swallowed—only the theologians and other aristocrats) is Many expression emphasizing *L*, then we may take it that "science" is the *T* emphasis; and we have the valid equation *Biblical ethics or theology...*×*Science...*=*God*. Evidently in that view of history and ethics there has been no warfare of science and theology, but a necessary reaction. And all that shows better than anything else I know of, that "Providence" takes good care of us—that the universe runs itself a great deal better than is often recognized. "Science" is usually supposed to refer to objective things or *L* chiefly, but is here considered in its human aspect: thus the equation shows fundamentally the tendency of *extensive* and *intensive* to reverse into each other. Also that equation is the widest historical generalization covering the past thirty or forty centuries rather definitely, that I can formulate (the expressions for man and woman are wider, and perhaps nearly as definite, as we shall see). The more or less obvious expansion of this paragraph would require volumes, omitted here.[165b]

c. The other aspect of the gaining of greatest happiness is the *L* aspect, or objective factor, or emphasis on neighbors in wider and wider circles. Economy of time first benefits ourselves, and so from that ordinary commonsense point of view is *Selfishness...*. The objective aspect of morality consists of first benefitting others—is *altruism* or *Unselfishness...*. —— Obviously, as soon as we give to others a pleasurable reaction with ourselves, they usually in turn directly react to give us pleasure. So in that wider view the extensive factor changes into, or identifies itself with, the intensive factor—just as we saw in par. b happened vice versa (§71f).

d. The chief increase in the *consciousness* of extensive morality—our chief gain in abundance of life from an *L* point of view—that has taken place since Christ's time, has been through, or is, the invention and use of vastly more machinery. (I use *machinery* for *any* part of the universe—any tool —which we may employ as an intermediary, or perceptible connection, between us and the more remote environment, such as pencil, paper, gun, locomotive, telegraph, clothing, fishing tackle, steamship, chair, house, lathe, etc.). The deliberate invention and use of machinery is the most directly moral conduct possible to us in the *L* aspect—it is a truism. For obviously, a tool is, while we use it, essentially a conscious spacial extension of our body or nervous system or spirit

[165b] As an incidental general proof of the correctness of the fact that the race has for centuries taken *T* as being so obvious as not to need explicit recognition (cf. §150), it may be noted that it is considered that Bergson made a first class discovery in explicitly noting the "subjective" existence of time or *T*. (Of course, many men did it before Bergson—e. g., Ward, in "Realm of Ends," claims to;—but perhaps they failed to *emphasize* it enough.) Aside from having pointed out the importance of time (actually it is of importance only from a formal or logical point of view: I was unable to make out whether Bergson *knows* time is a mere form, or not), Bergson's philosophy seems to me to be trivial and vapid—the sort of stuff that pleases "intellectuals" and ladies at tea parties. He fails to handle even that *time* rationally in the only book of his I have ever had the plodding patience to read through:- "Creative Evolution." It seems needful to notice Bergson because James recommended him so highly. It is simple why Bergson affected James so much:- James had been over-emphasizing the "objective" for years (while in that state of mind he acquired the dualistic Muensterberg—an error in his judgment of men in the opposite direction from his acceptance of Bergson), and had worked himself into the place where he saw he must go on to One continuity—to infinite pluralism more definitely than he had often previously guessed at it. James was chiefly a psychologist, and so that step was easiest for him via the *T* continuity of consciousness. So Bergson's emphasis on *T*, together with its equivalent idea, the ultimate Oneness or identical infinite pluralism of consciousness which is given by Bergson explicitly in recognizing or emphasizing *Emotions...*, was the last gentle push needed by James to enable him to sum to monism (Bergson calls *Emotions...* "intuitions" in an esoteric sort of way which seems to be pleasing to people who are too lazy to think clearly but like to make believe that they think—and very puzzling to the philosophers who politely took James seriously, to whom Bergson has become a sort of conventional enigma). So James in his first uncritical exuberance of gratitude naturally attributed to Bergson what was really in James. James had a rebirth, and wrote "Radical Empiricism," which is in agreement with this book although not commonly recognized to be of such a nature. I. e., James at the end was no dualist or finite pluralist, as he is usually supposed to be; but he did not live long enough to cool off, and see just what had happened to his views. —— The reader of James should remember that James led a very sheltered life; that gave him a delightful urbanity and sweet generosity, but at the same time it made his judgment of men poor and decreased his sense of personal responsibility for what he said until he apparently verged on being willing to be considerably inaccurate, not to say radical, in order to be entertaining. I like James as a man; but technically he is unreliable—a carelessly exuberant enfant terrible.

or soul, and hence is additional life. If a man uses the telephone, he obviously extends his senses and hence soul *definitely* as far as the other instrument. When we travel on a steamer we definitely put a large tool onto ourselves, with which we effectively and pleasurably (in sum anyway, in spite of seasickness) react with a comparatively large lot of environment. The man who controls the steamer (by various communicating apparatuses) can, if well trained, *feel* the environment through the steamer and feel the parts of the steamer, precisely as he can feel his own internal emotions or internal parts of himself. We reach out across a continent and get things with a railroad, and *live* there as definitely as we "enjoy life" by taking, with some other tool, a morsel of food from the plate before us. It is not customary to think of the use of machinery as being moral—as being perhaps in most cases more moral than going to church. But the mere statement of its morality becomes a self-evident truism.[165d] Machinery is a quantitative good, and so may be over-used or under-used; and often is. We also sometimes misuse our hands, which are also extensions of our bodies and tools.

e. We have seen (par. c) that the L aspect and the T aspect of morals inevitably merge with each other. That is the same as saying that *Unselfishness...* $\times$ *Selfishness...* truistically becomes $M(varying\ with)L^2T^{-2}$, M being any organic individual or natural structure (cf. §163j). That obviously agrees with the general law, mass varies with velocity, and may be expressed as the general ethical law (which may be put in many other forms):- happiness quantitatively amounts to the extensiveness (L) of *used* perceptions that can be compressed or "speeded" (T) into a given lifetime.

f. I omit all but a few ways of considering that general scientific form of the ethical law. There is nothing novel about that law, it clearly being simply a positively explicit statement of the truism that happiness or good is activity (or of Christ's general summation) from which we started—a circle of reasoning proving our expression of observations.

§166. a. It therefore follows that that maximum living, and-or maximum morality or happiness, consists (1) of consciously perceiving (reacting with) the environment (including in environment the parts of our own nervous systems or souls that are, to begin with, very dimly *Emotions...*) just as far out or extensively (L) as we can without going so far as to have such interaction become unconscious or painfully damaging (including not damaging others), and doing it as fast as we can (T), so that our memories of all the parts of the process will be vivid or intense; and then (2) stopping that swing out from the balance before it cumulatively painfully disintegrates or changes the structural order of our soul or nervous system, and then (after stopping) swinging back in the cycle, "resting" or recuperating in order to do it all over again. Each such swing by the theory of incommensurables tends to sum perceptibly in one direction from the balance (i. e., each actual swing is partly *Unselfishness...* and partly *Selfishness...*, but one or the other, by incommensurability, is preponderant, and often perceptibly so); hence, the maximum recuperation or final total morality consists of swinging about as often with one preponderance as the other. —— All that can evidently be stated in mathematical terms of maxima and minima.

b. The last paragraph probably seems as dry as dust, theoretical, abstract, etc. Yet it is a complete and definite solution of *What are the "important" things of life?*, of *What's the use?*—as we shall in this section proceed to see in a few details. It had to be put dryly or "unemotionally" in order to say so much. Of course the *quantities* which are tolerable or pleasant to any given person can be "solved" or measured only as a special case for himself (and usually he has only himself to do that measuring for him). Clearly, the amount of living or morality of a given person depends upon the sum of "toughness" of his cells. If he starts with all his cells in good balance, strong and healthy (has a "good constitution") he can usually live more than can a person less well endowed. But it is clear that if he has a constitution strong enough to understand or perceive the general scheme of the last paragraph just once (and I judge that 90 per cent of children reach that strength at some time in their 'teens), then by conscious ("intelligent") "nurture" of his self he can readily build that self up and live far more than a person of better inheritance who does not consciously go after what he wants but "trusts to luck." —— There is no space to expand this important paragraph—showing, e. g., that such varying inheritance is absolutely just (the key to that proof of justice being that here we are talking quantitatively).

c. In a fairly steady environment there truistically is a tendency towards wider definite organization (XVI). The steadiness of the environment of man is in a wide sense considered under the name *climate*. In a narrower sense steady environment consists of fairly stable societies, owning an accumulating amount of tools in the shape of recorded truth (traditions, proverbs, books, "science," "religion," etc.), as well as more material ephemeral wealth. It truistically follows that with a fairly steady climate men automatically (rather unconsciously the first time; and on perceiving the results on that occasion, more or less "purposely" thereafter) swing out in those happy cycles of the last two paragraphs. Doing so establishes a physiological memory (§158c), so that they as a rule acquire ability to swing further and further pleasurably. (Some go too far, and some not far enough, of course, and are killed off; or, in teleological terms, those excessive ones are not sufficiently desirous of being moral and happy to have the "will to live"—a truism.) That ability of individuals to swing further and further truistically implies a more definite, perceptible, and extensive social organization. And that increase of ability is in general progress, or advancing civilization. It is a circular process of cause becoming effect, and vice versa, like the cycle of universal structural 'vibration' that underlies it. And the tools or machinery of accumulated "truth" (the "social inheritance" which *is* the steady social environment) obviously acts upon each individual in that pretty steady environment and tends

[165d] Gerald Stanley Lee, in "The Voice of the Machines," shows in effect and with overwhelming detail that machines are moral, and when intelligently used are part of us. Lee I think is a great poet —and much evidence of the correctness of that estimate lies in the fact that he could actually feel the morality of machinery at a time when ordinary poets sniffed at machinery. Their objections really meant that they were too callous and uneducated (§164b) to be able to get the real feel of an extension of themselves through a tool; or sometimes they did feel such an extension, and with equal nerve callousness lost sight of the fact that they were using a machine, and denied that they were. —— Poetry is the first form in which truth is somewhat acceptably stated. That first statement would be so novel and repulsive as not to "penetrate" very well unless made perceptibly rhythmic in some respect. The poetical rhythm (and usually rhyme) is a formal device that makes the measuring more or less automatically pound its way up to the cortex (in the same quantitative way that a slight but rhythmic stimulus will shake a strong bridge down), in spite of the hearer's pain over receiving the new truth or idea itself (cf. §§158-9). And great poets like Lee have a sense of proportion (of rhythm, of harmonic periodicity) for *ideas* themselves, so that they can (with most persons whose brains are not attuned to jazz—dualism) make ideas reverberate into rebirths, so to speak. There is a primitive form of that in the Song of Songs and Job; the queer new poets we have nowadays seem to have an unstated intuition that the highest poetry is a rhythm of ideas. But their idea that they can get it by throwing away ordinary poetic rhythms is equivalent to the delusion that if we are the fortunate possessors of $10, by throwing it away we will have a million.

to cause him to build his self up and live beyond the point to which his physiological cell inheritance would go without being thus supported. In short, it obviously may be quantitatively possible that "nurture" in the form of "social inheritance" will "civilize" a man (cause him to have more life or happiness) in perhaps a more effective way than his inherited characteristics—than his congenital cell memories. The environment—the social structure around him—may serve him as a better 'memory,' as a stronger 'constitution,' than his congenital "personal" one. That quantitative *possibility* is, in some measure, held to be the actual fact by those who consider humanics to be primarily "sociology." For a very explicit assertion that the possibility is realized in fact, and that "sociology" is the "master science," see Kidd's "The Science of Power," and his remarks in "Ency. Brit.," xxv, 331. —— It thus becomes obvious that the "difference" between sociology and ethics (taking "ethics" conventionally as being more emphatically "personal") is a mere matter of quantitative guessing. My personal guess is that Kidd and some other sociologists (more particularly the amateur sort, who perennially rediscover a perceptible social structure or relationship into a One, and usually give it a new name) are specialists who exaggerate their specialty somewhat. The principle underlying that guessing is:- *Social inheritances or social nurture...*$\times$*Personal or congenital physiological inheritance and-or nurture...*$=$*Social or moral individual life* (or, *Sociology...*$\times$*Personal biology or personal ethics...*$=$*Life*); and my guess is that the *perceptible* phenomena may be about as often "ethical" as "sociological." —— So, to summarize this paragraph:- the general application of the complete ethical principle gives us the broad outline of what is commonly called *sociology* by modern writers (it is sometimes called *evolution*, or *social evolution*; also *civilization*, *social aesthetics*, *culture*, etc.; cf. §171).

d. The generally accepted "most important" thing in life, or its supremest happiness, is "religion"—specifically one or more religious experiences. Sometimes the "greatest thing in the world" is said to be love, and sometimes the "power" that money, etc., gives; but as *love* and *power* (over nature or material things, others, and-or oneself) are simply the humanistic names for universal relationship of identity it is obvious that that again means that the *perception* of them, which we may conventionally and conveniently call a "religious experience," is the greatest thing. And obviously, that general judgment as to the greatest thing is rigorously proved by the foregoing to be correct. For a religious experience or rebirth (§153f) is a swing out so far (*L*) that the infinite regress is more or less perceptible, and a swing out so quick (*T*) that the perception is vivid. It is now obvious that a swing too far destroys the man (§163).[166d]

e. But obviously, if we in a reasonably tolerable way—i. e., not too unbalancedly—see the infinite beauty of God or the universe, or see our own personal inseparable unity with God, or see that we are personally a part of the universe and hence ultimately indispensable or needed or useful, and fit in or are beautiful ourselves, or are not "lonely" and "unsupported" but are held up by infinite "grace" (or power or energy, if we prefer more definite terms)—if we see that general unity, without the ecstacy or happiness being too painfully poignant or nervously destructive, it follows that on that occasion of rebirth we have seen or experienced or understood the fundamental scheme of life and can henceforth know how to *live*—how to get the important thing out of life. —— That is of course repetitious. I have been deliberately repeating the description of a reasonable rebirth in various of the many conventional ways, so that the reader can scarcely avoid recognizing his own similar experiences (I shall give even more familiar descriptions of it from time to time below); and can scarcely avoid recognizing that a rebirth is, in brief, a conscious grasping or perceiving or *being* (§28h) the infinite regress that applies to *any* experienced unit of the Many. In that case (in the case that the reader actually sees what this book by consistent logic and direct evidence in all varieties of phenomena shows to be the truth), he can then understand that the important things in life are those rhythmic stretchings of his life or abilities—those *used* or cyclic perceivings of love or power or unity—as far as they will go *pleasantly* (for himself as well as others). And on occasions he may indulge in a cycle which is a bit poignant (such as earning a million dollars—earning it), as a means of increasing his ability to live (and all that is merely

[166d] It seems to me to be the fact that most geniuses, prophets, saints, seers, etc., have swung out so far on some rebirth that they were unable to recover very well, and hence were never afterwards quite sane in one or two respects. I. e., they did not in some respect recover the ability to judge what was the normal balance (§159f), and so were not able afterwards to "control" themselves. They usually, however, were quick to see and condemn similar intemperance in getting a feeling of universal unity in others when it took the form of power madness—especially when that power was represented by money, which is the sort of power easiest to perceive. So as a means of keeping ourselves temperate in getting rebirths in the more usual everyday forms of power and love, it is useful to note some of the intemperances in the rebirths themselves. —— Often the genius fancied that he should keep on in that state of ecstacy or rebirth or definite perception of unity or power or intoxicated expansiveness; Swedenborg did manage to keep on considerably, and became ratber definitely insane. Sometimes the genius temporarily allowed it to run along too much, and then violently avoided it the rest of his life (became, so to speak, intemperately sane like a standpatter—a mild insanity in the opposite direction). Some saints got such a painful rebirth that instead of calling it the usual "seeing God" or talking with God, they named it the opposite; thus Christ talked with the devil (§153g), and Luther said he threw his inkwell at the devil. In rough generality, one of two more or less opposite mental or physiological make-ups is required to get a *violent* rebirth:- (1) the victim much have a much disconnected ("unstable") nervous system so that one circuit may from rather usual stimuli get violently overloaded; such a condition may be "natural" (as in hysterics, paranoiacs, and other rather weak-minded or suggestible persons), or may be acquired by drugs, or by various disease poisons; (2) the victim must have a rather strong nervous system, which he by persistent 'stretching' finally gets more or less as a whole into an explosive condition. As the brain in a strong rebirth is perceptibly "exploding" ("seeing" violently, or to a considerable extent breaking up into different order structures), violent rebirths usually are accompanied by hallucinations (i. e., by perceptible internal 'emotions' or sensations, which effectively stir up considerable collections of memories, and hence if violent enough seem to be real visions, or voices, etc. Usually, the first experience of those internal perceptible explosions (*all* sensations give or are slight 'explosions,' or structural changes) is misinterpreted—considered "real." So the person having the violent rebirth sincerely makes a report of various extraordinary "visions." By overworking (strongly keeping up a concentrated strain of attention for two or three weeks), I can produce 'hallucinations' in my brain. The "seers," etc., of India do it that way (if they would concentrate on something more important than their navels the procedure might be useful to them); so far as I can judge, anyone can do it if he tries long enough, or judiciously uses various drugs (nitrous oxide, hasheesh, e. g.), or a little starvation. My first experience of those hallucinations was a bit startling; but I readily learned to recognize them for what they were (so that technically they are not hallucinations). As they are very wearing on the brain I have for some years avoided getting them. Quite likely if I had not known a little psychology and hence on the first experience recognized the danger of a violent rebirth, in spite of its feeling of infinite well-being and of power more vivid than money (or even money plus champagne plus a banquet) can give, I also might have been intemperately setting myself up in the prophet business and grabbing for additional such power more unscrupulously than the worst financial pirate—and paying for it out of my skin, as all such deluded persons do, by going more or less insane (i. e., by breaking down my brain somewhat and being unable to perceive—enjoy—any but destructive overdoses, like a drug addict).

the truism that the important thing in life is really living).

f. It then is obvious that *any* occupation is *essentially* able to give you those continual pleasant rebirths in a desirable and supportable cycle. The athlete at school engages in such cycles largely with his muscles; if he does not shirk (indulge himself by quitting before the last final effort or concentration or unifying or summing of his powers; §159d), or if on the other hand he does not overdo it and get into a condition where he does not easily recuperate (go "stale," or otherwise "injure" himself), then he obviously is stretching his capacities (including his soul or nervous system), and in some degree feels (both directly with his own nerves, and also by the plaudits of others; Index, "Fame") that he is really infinitely fitting in, is being "successful" or needed and an indispensable *active* part of an organism. (The reason the athlete sometimes does not take kindly to "books," even when he has the available energy, is that somebody has given him the erroneous idea that the writer has done all the work for him; also, nobody has shown him just how books fit in—assuming that those offered him do,—or is able to judge the athlete's "success" with them especially well.) The athlete usually can not juggle words well enough to express all that definitely (word juggling is another form of athletics with more possibilities and dangers than football); but obviously that is what he feels—a bubbling well of nerve enthusiasm that draws its energy from all the environment and then pours it out in floods, effectively and joyously and with increasing quantity (provided not overdone), back to the environment. His athletic contests are hence, rigorously, a definite species of religiousness—an explicit religious experience he can grasp and apply. If his teachers can make it clear to him that Greek verbs will bring him into perceptible contact and union with all of life, and hence are ultimately of infinite "importance" and use and beauty, then he will tackle Greek verbs in the same way, and get just as much religion, or the *habit* of success and power and the wholehearted work that accomplishes the "impossible," out of those verbs. And obviously, Greek verbs *are* as inseparably connected with the whole unit life or God as athletics are. Their *comparative* values are small, so that few people are competent and interested judges of either; so the person who customarily gets his religion by either can get but little actual guidance and support from others, and is likely not to have the strength to keep himself out of quantitative difficulties—all of which we implicitly see in discussing value. —— If you are engaged in growing potatoes, then potatoes are obviously a link that connects you inseparably with all, along a path over which can flow all the energy, or life, or activity you are capable of sustaining and enjoying. There is no limit to the spiritual equation *Environment...*×*Potatoes...*=*Universe or God*. This book rigorously proves that there are more emotions, more facts, more sensations, more mathematics, more uses, directly and inseparably connected with *Potatoes...* than you will ever be able to grasp definitely. It is obviously just as moral or just as religious to exercise yourself, to live, with that potato equation as with the general, bookish one *Unselfishness...*×*Selfishness...*=*God*—and much more so than it is to go to church and hear a minister do it indirectly for you. In actual practice, if you truly understood and hence got enthusiastic about either equation, if you began to enjoy "real life," or to be highly active because you *wanted* to be and enjoyed being, then you shortly would have made yourself many other equations—would have necessarily gained many "interests." The equation you started with is merely your prime quantitative standard. *Any* form of *That...*×*This...* sums into a valid religion.

g. "Real" living or moral and happy life therefore consists in persistently 'observing' (that including all varieties of "reacting" with) things as they are until we consciously get a vision or perception of their relationship into the One, and then further consists in thereafter repeating those rebirths in rhythmic cycles that are temperately pleasurable to us and our neighbors. Usually the mistake we make is intemperately running one factor too high—hurrying, grabbing, jumping to conclusions, getting rich quick; or, in the negative direction, wasting time, shirking (which in higher executive circles is called passing the buck), and, in general, quitting. Clearly the fundamental error in life is to get so in the habit of making that mistake of intemperance that we begin to assert that such an unbalance is right, and so begin to try to run various things or factors to infinity, and others to zero, thus logically absolutely "separating" them, and becoming a dualist or aristocrat—more or less dead, immoral, wicked, 'insane,' irrational, etc. As a rule nature or "Providence" automatically controls us subconsciously in greater part, so that such a mistaken outlook in life is usually mostly verbal, and such a verbally wrong person ordinarily does not become pathologically insane. Ordinary men often try to follow and emulate an insane "leader," but nature automatically stops those quantitatively ordinary men far short of achieving such insanity or gross radicalisms. They take it out in "talk"—one reason why "talk" is cheap.

h. Perhaps the most common of such general mistakes of intemperance (apart from ordinary loafing by the poor workman, and passing the buck by the cheap executive—usually a politician) is the view that the essential way of having a rebirth (or the spasmodic cure of that opposite loafing) is to have theological technicalities pounded into us with sufficient violence, more or less as "Billy" Sunday does it (cf. footnote d). Usually that violent pounding of the brain with a narrow set of stimuli (if the hearer is not wise enough to avoid it) results in putting all but a few nerve channels somewhat to sleep (mildly hypnotizing most of the brain), and then and thus overloading the active ones until they perceptibly explode—frequently into an obvious hysterical or even more maniacal convulsion. —— Precisely the same effect can be got in possibly most cases by putting the brain largely out of connection (to "sleep") with alcohol; in that case the ordinary affairs of life coming through the remaining channels keep them at an explosive pitch of intensity, and that truistically gives the somewhat drunken man the customary moderate rebirth—a feeling of extraordinary well-being and of power and complete living and infinite love. (Some men, apparently "stolid" ones that take up food and stimuli rather slowly, are not much affected that way by alcohol; if they were to take enough they would be, but usually some other organ breaks down or rebels before the brain gets that effect). The worship of Bacchus (some of the ritual of which survives in present-day "communion"), as well as the use of alcohol in conviviality (that word itself means a loving organization or unity of men), are objective proofs of the fact that alcohol does give such rebirths. The objection to that sort of rebirth is the same as the objection to the emotional theological sort, or to any sort of ecstacy caused by persistent harping on one narrow theme (such as the oratory of the demagog, etc.):- the person who experiences it is likely to overlook the fact that its value lies in the perception of the One; so he is liable to become narrowed instead of expanded, making an idol of alcohol, or of the church, by considering it the *end*, rather than the *means* of the rebirth—just as money, or red tape, or oratory, or a narrow specialty is often mistaken for the reality. A further objection to alcohol is that it often wears out the nervous system faster than it can recuperate (thus introducing the economic problem of whether

the rebirths are worth the time needed for recovery). Probably in former days when men were more stolid alcohol did not have that latter objection, and was much more of a good than an evil. But it seems to be a fairly safe guess that alcohol destroys a present-day keen and quick brain faster than it can recuperate; if so, its use by *such* men is immoral. The change in the nervous systems of mankind has perhaps on that ground of giving too violent rebirths (which is the crucial point) made the use of alcohol in appreciable quantity in some degree immoral for the majority of the mature male adults of this country. It has nearly surely long been definitely immoral for all the females (for psychological reasons implied in §170). It is possible that the alcoholic rebirths are somewhat needed by the young male adults, and by the more stolid. But it also seems to be a reasonable guess that this country needs legal prohibition:- for any kind of rebirths in excess is immoral, as has been seen; the men in the liquor trade by obvious principles would be, and in glaring fact increasingly were, in general, fools who were determined, for quick money profits, to force an excess of alcohol upon people; and the only practical way to deal with them is to eliminate them—as is being done. Alcohol is very easy to make, and those who can profitably use it can also develop self-reliance by making their own.

i. In contrast with those usually overdone ways of getting rebirths by overworking some narrow channel, we may observe the most usual way of getting the important things out of life. In fact, so common is this way we are to see, of living a real religious life, that it is rarely recognized as such. But the fact that it tacitly is actually recognized as such by most persons is evident from the glaring fact that they spend more effort, time, and money on this way than on all others combined. And that fact is truistic proof that the race is fundamentally sound, vigorous, right, religious, lovable—in spite of all the superficial "intellectual" idiocies and radicalisms with which it is afflicted; in spite of all its ephemeral warring creeds and dualistic theologies. This ordinary temperate way of being religious and moral, of getting the important things out of life, is marriage.

j. It is perhaps evident from the mere mention of it that the most vivid or intense as well as extensive direct experience or personal experimental evidence that a human being can have that he or she is directly and inseparably related to the rest of the universe is sexual intercourse under normal matrimonial conditions. It is shown by the discussion of sex in §146 to be a truism that the climax or orgasm of sex union is the most perceptible normal rebirth that an individual can have. —— That orgasm theoretically differs quantitatively (in L and T) with respect to man and woman; for that and other remoter modifying details of this paragraph, see §170. Further, the sex cycle of both man and woman is completed only by the birth and up-bringing of a child; so in that the intensity, and physiological extensity, of the rebirth is directly extended in perceptible infinite regress. In short, the prolonged infancy of the child leads to the progress of the child, but perhaps mostly does it because the prolonged infancy first gives the parents (the father usually does not so fully use this opportunity as the mother) a wider grasp of reality, so that they then impart it in some degree to the infant. John Fiske first worked out the details of that. —— This paragraph can not be adequately discussed in less than a volume. The short parenthesis about the father's often neglecting his opportunity might profitably be expanded that much. Some additional comment is given in §§167, 170. In the rest of this section we may briefly note a few general ideas implied by this paragraph.

k. The chief implication is that such sex life is *rhythmic* if normal, and so, *for persons with fairly keen and sensitive brains*, requires monogamy. For such persons a greater degree of promiscuity (even legal monogamic unions that are intended to be temporary) is obviously likely to be destructively intense (cf. par. l). So various sorts of sex promiscuity or deliberate temporariness (including levity and carelessness in divorce; par. n) is obviously moral for a barbarian, and is the mark of a barbarian or a person still so youthful or undeveloped as to be psychologically in the barbaric stage; but it is immoral for an adult in the degree in which he is civilized. (Those *quantitative* remarks apply to a male; they apply in much greater degree to a female; see §170).

l. The general historical evidence in support of the last two paragraphs is the fact that in older theologies sex intercourse was rather definitely recognized as being a religious rebirth, and a ritual was made of it—i. e., sex intercourse became a formal way to "worship." Such promiscuity, even though verbally sanctified by the theologians, as alcohol is now doing, slowly became too violent even for the coarser men, and was mostly dropped before Christ, although occasional sects still arise among callous people which try to ritualize sex intercourse. —— Immediate objective evidence in support of the two paragraphs is that literature uses sex, or "romantic" love, or "passion," as the chief spring of action.

m. The important practical implication of par. j is that *in a normal marriage each spouse truistically is to the other the chief or primary or most important God the Son in existence, or ever in existence.* That conclusion sounds queer, of course; various demagogs and autocrats, especially the priests, so fill the air with verbal clamor that we must come to them to be furnished with the chief God the Son, that being obliging and peaceably inclined and a trifle lazy we have grown superficially accustomed to taking their word for it. Yet that odd looking conclusion (that a person's own, selected spouse is his or her chief God the Son) is glaringly a truism in a *normal* marriage (it is quantitative, and not invariably true):- Christ, or the pope, or a deified Nero, or even a local autocrat or boss, is obviously much further off from us in most ways than our spouse, and so we necessarily *primarily* react with the environment through the spouse (if the marriage is fairly real or successful—as I judge about 75 per cent of marriages in this country are: more than in any other country or in any past age). At the beginning of marriages, when the relation is novel, the conclusion is usually clearly asserted by the couple:- as they do not understand orthodox theological terms (even though it pleases them to use such terms ritualistically), they use direct and intelligible terms and see and state that to each the spouse is the most important, "best," finest, etc., person in the world (it being further tacitly accepted that *persons*—structures of our own order—are the most important thing to us; even in a machine shop). And that statement made of spouses is clearly equivalent to our conclusion as expressed in ethical terms. And the conclusion is further proved by the obvious facts that the majority of people (1) are primarily *interested* in working for their spouses and for the more or less parts of their spouses:- children; and (2) generally use the spouses as a chief standard by which to judge their own acts. It is quite true that a married couple often do not keep on very long stating the conclusion definitely in words to each other; it is too real and obvious for ritualization. (If we keep on repeating the same thing after the novelty wears off, it implies either that we do not with any definite conviction believe it or really understand it, or that we still doubt whether the hearer does.) It becomes so obvious to them that they are each other's chief God the Son that when the theologian talks about Christ's being the primary God the Son they really do not know what

he means (and usually he does not either: if he does he is publicly depreciating his wife, if he has one); so with a deep consistency not appreciated by the theologian, they go to church if it doesn't rain and drop a penny in the plate.

n. Clearly therefore marriages are not made in heaven but are heaven if they are made. The theological claim that the priest can by fiat make a marriage (so that it *does* exist—each spouse being the chief God the Son to the other *in fact*, so that the marriage is indissoluble in the sense that what is, *is*) is obviously a trifle too silly to be discussed by this book. (Our neighbors for various evident reasons need to know when a marriage is entered into; so the priest fundamentally serves as a town crier.) —— Obviously, a marriage may be entered into honestly by the partners and may be successful for a while, but may in fact cease to exist because of *a different rate of growth* of the spouses. Or, the spouses may have been mistaken, so that the marriage never in fact existed—regardless of what the priests or lawyers may assert concerning it. The existence of a marriage is a question of quantitative fact. If by ordinary agreements as to measures it does not exist, then the principle truistically is that the priest or legislator or judge who asserts that it does exist is either a liar or a fool, or both (that of course applies to the men who refuse divorce entirely, or base it upon arbitrary grounds—as will appear). As the legal and-or theological ceremony of marriage is necessarily a quantitative guess that a marriage will exist in fact, it follows that if it does not come into existence, or happens to go out of existence, then another quantitative announcement called divorce is *truistically* required. A volume is needed for a definite discussion of the quantities involved. Possibly the safest practical way to judge whether a divorce should be announced is this:- if a person applies for a divorce he [or she] obviously thereby publicly admits that either he has been sufficiently foolish to make a mistaken judgment in an extremely important matter or is in effect such a poorly developed person as to want sexual promiscuity (or both); so if the legal formal existence of the marriage will force that public humiliation, it is rather obviously proved to be not a real marriage and to warrant a legal divorce. There is no space to consider the complicated quantitative problems of children, support of children and other directly economic problems, remarriages, etc. Stringent divorce laws, however, neither solve nor obviate such problems, but simply wholly or partly deny that they arise when no legal divorce is granted—which is as silly as denying that the sun rises, and as immoral as any other lie.

o. It is probably a historical fact that up to modern times most men *verbally* considered woman to be an inferior and a sex machine (meaning that she was chiefly a means of gratifying sex appetite), or to be without a soul (for details, see §170h). St. Paul, with genuine Prussian or Athenian arrogance and stupidity, very definitely asserted woman to be inferior and to be a sex machine; and the orthodox theologians and many men *verbally* have not yet developed past that barbaric coarseness and primitive dualism. (I am of course aware that such radical, classical logic talk has been largely make believe—that the mass of commensense men in practice but slightly inclined to such nonsense.) —— It follows even more strongly in the face of that historical tradition and present orthodox theology, that the much noticed tendency of the men of this country to consider women to be more or less "angels" (1) is a proof of the progress in civilization, (2) is a proof of the general correctness of the conclusion as to who is the chief God the Son, and (3) indicates the general moral soundness of the people of this country (the upper ten and the submerged tenth that aristocratically agree with Paul are merely almost negligible scum and dregs). Perhaps the men have overdone the "idealizing," resulting in some damage to women. It has been a good thing for the men in some ways, but possibly rather bad for numerous women. I. e., many women has been so weak (narrow visioned: unable to stand "prosperity") as to take a selfish advantage of American men, and become more or less parasitic. Such women substantially consider that to catch a man in marriage is to have secured a living for the rest of their lives without work or further return to the man. In practice it is possible that the woman is not able to live up to the high place that is assigned her before she works for it and earns it. It seems to be becoming more or less necessary for the American man to require the woman to earn her high place. That of course is an individual quantitative problem to be personally solved by each man and woman. The only *general* solution I can see for it is this rough one that must be modified for special cases:- The worst sort of female parasite is probably the woman who after capturing a husband and a living thinks it right to keep the living and drop the superfluous husband. She is the alimony chaser. I found by a too slight investigation that apparently the majority of financially fairly well-to-do women have the poisonous belief that if they wish to divorce their husbands they will still be entitled to support—the alleged right having accrued simply by matrimonial capture. Mrs. Gertrude Atherton plainly implies ("Delineator," Dec., 1916, p. 12, "What is Feminism?") that men ought to be "clever enough" to support financially all women "without independent means." So perhaps we need a general educative law that divorce will be granted much more easily than at present, and that alimony will be granted only in rare (described) cases. That would be equivalent to serving formal notice that men can not be matrimonially exploited, and such feminine parasitism or something-for-nothing as there may be, would die. —— The difficulty of passing such laws lies in the fact that men of the Prussian Pauline type who wish to domineer over their wives, and the equally barbarous meek and docile type of women who like it, are a very noisy minority. They prefer and demand difficult divorce laws, with women convinced that they are financially dependent on men, as such laws save their face in such coarse and callous conduct. E. g., §79 of Cummings's "Marriage and Divorce Laws of Massachusetts" mentions a matrimonial atrocity explicitly permitted by that presumably civilized state which is so nauseating as to be unfit to print in anything but a book on lawyers' law or pathology, where such things are expected. It is not accidental that the rate of insanity is much higher in Massachusetts than in Western states which, as a cause and a result of such cleanliness, have freer divorce laws.

p. There are numbers of people who assert in one way or another that marriage is not the most effective or desirable way of living the best life. As the problem is a quantitative one, and as the theory given above is rigorous, it obviously follows that such opposite opinions are quite correct for certain abnormal persons. Frequently those who assert such opposite opinions merely indicate by them that they are not normal. —— Perhaps adverse opinions are expressed most often by those who have not been married. As they have had no experience of marriage we may neglect them as being incompetent until they are able to give theoretical support for their views. —— Possibly the next largest class who consider marriage of secondary importance or even undesirable, are the hysterical, or others of the aristocratic, parasitic types who have narrowed, abnormal nervous systems. Many hysterics are sexually insensible (or, in order to be "different" and thus attract attention, or to seem to be "refined" —a corpse would be much more so,—they keep pretending

to be sexually anaesthetic until it probably comes to be so); hence it is probable that they could not get a rebirth by marriage, and their adverse opinion is correct for their pathological selves. Many men will be saved years of trouble if the hysterics refrain from marrying for parasitic purposes. In all cases people with narrowed nervous systems are obviously liable not to be able to withstand that necessarily long continued need of delicate mutual adjustment between two persons which builds up the successful marriage. So they are forced by their defects to make marriage a secondary part of moral living. —— The last general type of people who oppose marriage may roughly be named the "artistic" sort —meaning those who tend to be the unbalanced genius who wants not a full life but a "career," a career being an ostentatious bid for attention and reward with considerable neglect of the essential point that they should be earned. It is possible that such people by avoiding marriage may thus conserve energy to produce useful work. Newton prided himself on not marrying. Newton also became practically insane for some months and for years wasted his abilities by acting like a prima donna. It is obvious that if a person can manage to generate enough enduring nervous energy to keep steady in a normal married life, and still have enough over to use for the occasional abnormal requirements of any unusual work, then such work, by the principles of a flywheel or rhythm, tends to be balanced and enduringly useful—not momentarily spectacular and bizarre, and usually grossly exaggerated to the point of vitiating dualism. It is well known that the person who is able to depart widely from the normal usually finds it difficult to retain enough surplus energy to balance bimself [herself] in marriage: his wife finds it hard at times to live with him. But clearly, if he is not strong enough to balance himself with a fairly normal wife (but he usually picks a hysteric; e. g., Carlyle, Socrates), he is not strong enough to do enduring work. The bizarre, rather dualistic stuff he does do will be very noticeable, but some stronger man will always have to straighten out the mess and throw most of it away. In brief, this last class of opponents of marriage is identical in character with the hysterical and more or less pathological class of unbalanced persons; the "artistic" or "career" class is simply less unbalanced.

q. Because marriage is so important we may readily judge people's general character and the value of their work by their attitude towards it:- The youth's usual scorn of marriage merely indicates ordinary human conservatism towards the unknown and unexperienced. —— The extreme socialists (§175c) disapprove of marriage or want promiscuity or various other barbaric modifications of marriage. The late kaiser, Paul, and the theologians, with similar aristocratic dualism also consider woman essentially inferior. And their "work" is useful chiefly in showing how not to do it. —— There is an extreme type of feminist who substantially says that women should fight men—makes an absolute dualism of the two. It is hard to say just what that ultra-feminist does want, as she (or perhaps it would be biologically more accurate to say *it*) is very self-contradictory; but she seems to say that women should oppose marriage, although it will be a good thing if the woman can get a man to support her if he will not then hold her to the responsibilities of marriage. At least that is what I make out of what Mrs. Gertrude Atherton says feminism is in the "Delineator" (Oct.-Dec., '16; also cf. par. o). If that is what she meant, then this book is not the proper place for fitting comment. Mrs. Atherton says she was delicate, with a weak back, and strolled through the woods, and considered her two children as dolls, and her husband looked after the housekeeping and did the cooking when the cook left and died shortly. I understand that such is what she thinks is fitting; it sounds somewhat like hysteria to me, but I would not venture to guess that the lady has hysteria or ever had it. (I quote some quite restrained remarks about the husbands of hysterics from p. 911, "Health and Disease in Relation to Marriage and the Married State," edited by Senator and Kaminer:- "It almost appears strange that so many marriages of hysterical persons last until their natural end and are not dissolved long before that. *** [The husbands of hysterics] appear predestined for their severe ordeal which they often endure so bravely as to call forth the wondering admiration of their sympathizing friends and medical advisers.") Mrs. Atherton herself rather implies that she is an artist, and in that connection, in "Woman's Home Companion," Dec., '18, warns young women not to marry if they have talent, letting their careers pass them by, and then substantially says that when they get older they may have commonsense enough to refrain from passion and marriage. She says that one's sense of responsibility for what one writes is satisfied when one sees the last proof sheet (that isn't so for me), and objects to the continuing responsibility of children and a husband. All that is obviously a dualistic chopping of the world into separate parts, and open praise of lack of enduring strength, or patience, or reliability (which is the normal woman's charm and valuable contribution to the race; §170). And in consistency with that "artistic" temperament, her writings are hard, brilliant, self-contradictory, and shallow. In the true artist's equation *Style or form...*$\times$*Ideas or substance...*=*Truth or Useful Work*, she attends emphatically to style and does write technically well—is easy and sharp and facile and flashing, and hence as noticeable as a conflagration. But she attends so little to getting in real substance, that what she does say in that fine style is practically worthless. Quite likely she will make for herself a fairly enduring name among the famous, which she implies is her desire: so did Ananias.

r. On the other hand we have women whose explicit recognition of the fundamental value of matrimony is so clear and balanced that it with others like it is the base of religion and the stabilizer of all work and character. In the same magazine with Mrs. Atherton's disruptive screams ("Wom. Home Com.," Dec. '18), Mary Heaton Vorse, in her usual calm and truthful manner, gives a description of a home that is explicitly 'dotted out' to a One and a normal rebirth; the argument of this section is the bare logical skeleton of her more humanly intelligible remarks. —— And Maude Radford Warren has written much about the normal woman that is more appreciated by an intelligent person than Mrs. Atherton's brilliant errors—although the style is not "up" to the taste of a jaded "woman of the world" (i. e., one mentally mutilated by tea fights) and other sorts of "Artists" who need tobasco and various sorts of catastrophes and New York inspiration before their worn-out nerves begin to register perceptibly. —— I think that Dorothy Canfield Fisher most clearly and beautifully shows in her books the most important things. In the story "Vignettes from a Life of Two Months" (in "The Real Motive") she precisely describes a normal yet infinite religious experience in caring for a baby. All of her books have the same temperate activity that is at the same time so universal as to pleasurably stretch the life of anyone as far as it will go. And that is actual art (§171), because it is true and important; it is clearly both the One and the Many, apparently overwhelmingly infinite, yet at the same time most simple and commonplace. By being a simple, everyday mother, like most American mothers except probably with more enthusiasm and liking for that most difficult job, Mrs. Fisher experienced enough to write an expression of universal motherhood:- "Home Fires in France."

As a religious writing I believe that book is better than Job.

§167. a. We saw in the last section that maximum or most moral living consists of a series of cycles as far out (*L*) and as fast (*T*) as we can comfortably live them. Then we saw that *any* sort of life or activity (expressed generally as *any That...*×*This...*) is capable of giving that maximum life, but that the most direct way, both extensively and intensively, of getting it is the immediately personal way of marriage. Evidently, in such personal union *Unselfishness...*× *Selfishness...* has *Selfishness...* and *Unselfishness...* directly personally and hence very perceptibly represented respectively by one's self and one's spouse. Then the dots that must pertain represent, first, children, then one's work or interests, and so on ad infinitum. We shall in this section make a rough general survey of those dots and the reactions, omitting from it explicit consideration of the important dots *children* (it becomes verbally complex and takes much space to take children even nominally distinct from the spouses).

b. We first, for simplicity, consider a married couple, *W...*×*M...*, with the man, conveniently named M, the intensive factor *M...* or *Selfishness...*, and observe their reactions (more or less omitting *explicit* mention of the dots), as a means of getting the general names and an understanding of such activities. Then we apply those familiar names to the wider whole universe. —— If M considers himself, he is a skin-bounded God the Son, and ultimately is God the Father; and as the latter his wife W is a *part of himself* with which he reacts. In order to get that ultimate One feeling or life or happiness, he must be able to react so intensely with W that he perceives the reaction from her as identical with his own actions. So when M shifts from ineffable monism or mysticism to a positive and tangible science or pluralism or practical life which clearly 'supports' and gives definiteness to his religion, W truistically becomes to him his most important God the Son. So M uses his reactions with W as standards, or class names, or base of judgment, of his interactions with the Many, and it is at those standards we are to look briefly. Clearly, there are thousands of sorts of human interactions conventionally named (i. e., measured); so I shall not go further than show the method. If the reader will refer to Hobbes's "Leviathan" (part "On Man," especially Chaps. 6, 10), or to Cabot's "What Men Live By," or most modern American texts on ethics, he will find implications that will guide him as far as he cares to go further with those humanistic names. Hobbes wrote about three centuries ago, so his logic is much too sharp; but Cabot uses the valid logic excellently—almost explicitly,— showing that he is a first class thinker and reliable.[167b]

c. If the man M reacts with his wife W with his attention primarily on the fact that he acts because he likes to, and without waiting to see any resulting reactions from W, then he obviously is *playing*. Truistically (taking it that he is fairly normal) he will stop such activity as soon as he becomes a trifle tired of it. So such play is *pluralistically free*—i. e., there is no *perception* of constraint, of subsequent reaction that has to be met appropriately. (In a One sense, the man is always absolutely free; §157.) *But*, if M has his attention perceptibly on the fact that his action with W produces a desired reaction, then M is *working*; and he is pluralistically perceptibly constrained or not free—for he has to control his action so as to produce the desired reaction, which is equivalent to saying that *W controls* his action. When he is playing, his action as a truism of definition is selfish; when he is working his action is usually called unselfish, because he

[167b] That implies a valuable practical point. Those men (and women, of course) who before the publication of this book were so sound and balanced that they automatically and tacitly used the valid logic in a perceptible fashion, *and applied it consistently through a wide range of practical details*, thereby demonstrated their unusual reliability, and the thorough excellence of their characters. You can trust them; the most of them made some easily-found logical mistakes, but those mistakes were superficial and trivial, the characters of the writers preventing any serious error. —— But you can not in the future broadly judge men that way; for any fairly intelligent child will be able in the future ostensibly to use the valid logic. You can not safely judge my character by the fact that I use the valid logic, for I am conscious of doing it, and have formal rules to follow. We saw (§43) that the one *logical* error is to exaggerate anything to zero or infinity. So as long as I do not do that (as long as I formally avoid becoming *absolute* when talking of the Many, and vice versa with the One) I am *logically* unassailable. *But*, now that I know how to be *logical* and find it reasonably easy to be so, it is obvious that I can in practical effect lie to you *rationally* if I so desire, by the simple process of subtly overemphasizing various quantitative or practical measurements. You see, *before* the valid logic was formally stated, anyone who tried that little game of subtle exaggeration of emphasis (anyone who was not inherently honest—which means inherently sane and hence reliable) was practically certain to fall into the trap of going to zero or infinity, and use dualistic logic. So those men who before not only rather definitely used the valid logic, but also *applied* it to wide classes of details consistently, are the most reliable. Cabot's logic is applied extensively. Jordan has applied valid logic to practically every phase of life and knowledge (§49p). Dewey has applied it for many years to the multitudinous details of psychology, philosophy, pedagogy, and ethics (§49p). Lee has applied valid logic to democracy. Taylor and many of his co-workers —Gantt, Cooke, etc.—have applied valid logic to the vast domain of industry. Hoover definitely uses valid logic ("Saturday Evening Post," Dec. 27, 1919) in the wide range of economics and sociology, and has also applied it in actual business. Taft uses valid logic with remarkable steadiness and precision. Lorimer and Bok have applied valid logic in their publications, by trying to give as much as they could to the other fellow, and using commonsense in publishing truth (and the fact that they have made a financial success of it is direct evidence that the American people are sound, and appreciate such reliability). And Ellery Sedgwick is doing the same thing with the "Atlantic." Lorimer has also written sound logic extensively (in his various letters of "old Gorgon Graham," which seem to me intrinsically much better than Montaigne), and George Ade, Tarkington, Harry Leon Wilson, E. W. Howe, Stephen Leacock, and Dunne are still doing so. Schwab and Grace and Foster are applying the same thing to the difficult job of making steel. Mrs. Fisher, Mrs. Vorse, and Mrs. Warren (§166r) have applied valid logic to the extensive range of daily living, and Mrs. Fisher has done it in pedagogy also. A. D. Little is a successful pioneer in soundly applying chemistry to industry—the widest engineering of the future. And that list is not complete—there are Edison and Wanamaker and Ford and others. So there are as great men and women now as there were in the olden days—in my opinion greater and better. And this footnote shows definitely why they are great (for proof that those people are courageous, which is also a necessity of greatness, and another aspect of reliability or honesty, see footnote 170r). And I judge that there will be better people in the next generation. If there are not, that generation should be ashamed of its failure, and go to work in silence to remedy it, instead of with gentle futility reminiscing over past glories. —— So obviously you may judge a man's general character or reliability by those principles. But that *judgment depends upon your own sanity, temperance, or reliability:* you truistically must use youself as a standard of comparison. If you think that if George Washington said some man was great, then you can take his judgment and be correct, you are wrong: you have to use yourself finally to judge Washington's reliability, and merely because you do not mention or think of that basic estimate does not in the least change the fact that you use yourself as the standard and that *you* are doing the judging (else you truistically are merely mouthing some words that are meaningless to you). So why should anyone be so silly and verbally cowardly as to say that he is accepting the judgment of "posterity" and other such "authorities"?—but of course the reader who has lasted so far in this book has too much intelligence to fool himself that he can dodge responsibility that way. —— Also, no positive *logical* way can be devised to catch a liar who knows the valid logic, if he keeps his wits about him (for a lie in that sense is a conscious *quantitative* perversion, and there can be no exact science: possibly a lie in the old sense is a conscious total or flat or qualitative or 0-∞ perversion; but that is now merely a logical error, and silly to tell to anyone with a knowledge of logic). But the liar always labors under the disadvantage that he is less intelligent than other persons (otherwise, he would not be so foolish as to lie). So in the long run all liars are certain to be detected.

is *primarily* attending to a reaction of W—an objective thing. (But clearly, monistically there can be no distinction between selfish and unselfish; and pluralistically the distinction after a few steps along the dots fades out.) The essential point in M's *working* is that he can not stop when he likes, but must attend to W's reaction and stop either before he likes or keep on after fatigue sets in, depending on W's wishes. If M must keep on working until *unduly* fatigued his work is named drudgery (and there correspondingly, in the opposite direction, remain some *parts* of him unduly under-used, or bored, or "suppressed"). Also, such undue lack of freedom is named *slavery*, which obviously can not be absolute.

d. If we use "religious" terms for M's activities we get some verbally unconventional conclusions. So long as M is free, or playing, in his activities with W, his activity is equivalent to what is called *worship*. Worship is primarily a selfish activity—play. It obviously does not do Christ himself as a skin-bounded person any good to be worshiped now; he is dead, and personally knows nothing about it. It does the worshiper good—stretches his perceptions somewhat, in an effort to encompass as much as Christ did (although when the worshiper labors under the delusion that he is graciously doing something that Christ highly appreciates and hence is "working," probably his perceptions are being blunted: I should call such activity *self-worship*; cf. the late kaiser's "worship" of Gott). —— When worship is considered to be controlled by its object, then it obviously begins to be in the borderland between play and work, and its most usual name is *service*. But there is so much lack of perception as to the true nature of worship that conventional distinctions are confused:- the minister "serves" the Lord by "worshiping" by some schedule, and he gets paid for it (he has his attention in some degree on the money that will come back or else he is a species of dualist:- economic idiot); but the layman worships because he likes it, and hence he pays for the privilege. (Sometimes however he works at worshiping so as to be paid the approbation of the community—in which common case "religion" becomes actually a sort of "police force" in which the "pillar of the church" shines—but at a terrific cost to society, as such "worship" involves some lying; e. g., the well-"policed" Middle ages; see Walsh's Catholic "The Thirteenth, Greatest of Centuries.") *Ritual* is a formal routine of worship. When it becomes thoroughly rutted into the nervous system it will obviously run through so easily as to give, if in large enough doses, a mild and normal rebirth (mostly of an emotional nature, because it is impossible for a sane intellect to accept as literal truth most rituals). Like the use of all things, the temperate use of ritual is good (I like to hear the Episcopal musical ritual so far off that I can't distinguish the obnoxious words); but if ritual is taken seriously, or as a substitute for work or actual thinking, it becomes pernicious just as do fairy stories if they are believed. Fairy tales ignore the existence of relationship, of cause and effect, to some extent. If it is not recognized that such is the fact, and that we are playing at being foolish and thoughtless (as we, even as little children, clearly are doing in "Alice in Wonderland"), then fairy tales truistically are immoral. Fairy tales are often supposed to exercise the "imagination." But obviously, unless clearly taken as a lesson in how not to do it as in "Alice," they truistically kill the imagination (a reaching out for the unknown next related or consistent thing or fact). In moral ritual we do not play at being foolish and thoughtless, but play at being children again, with disregard of practically all intellectual relationships: we are stirring up pleasant emotions. So ritual is primarily emotional. —— Corresponding to it on the intellectual side is *prayer*, in *Ritual*...$\times$*Prayer*...= *Emotions*...$\times$*Intellect*...=*Worship*,—that *standard* universe *Worship* being expanded thus:- *Unselfishness*...$\times$*Selfishness*... ="*Deeds*"...$\times$*Worship*...=*Work*...$\times$*Play*... =*Life*, from which we may see the principles. There is not a great deal of intellect about some orthodox prayers (in which case they have reversed to *Ritual*...); but obviously *Prayer*... is efficacious in the same sense that intellect is (§§153-4).

e. Because people have been uncertain and often self-contradictory as to what they did mean by those various "religious" terms, those terms are vague. They conventionally show a tendency to be used as both extensive and intensive factors; above I had to guess at the more common usage, and I did that simply as a means of showing the principles (I have no perceptible desire to regulate verbal usage, but am glad to take conventional meanings if there is consistency in them). That conventional uncertainty as to the meaning of "religious" words itself shows that the average man does not take orthodox "religion" or theology very seriously. —— We may note further that there is conventionally no widely agreed-upon word that indicates intemperance in religion—a proof that theologians in effect urge intemperance. The word *pious*, which formerly eulogistically denoted excellence in the important things of life (tacitly taken as being the religious things), is now tending to indicate intemperance in religion and hence wrongness. Sometimes "fanatic," or "religious crank," is used to indicate too much "religion." When the man M gets to worshiping W too much he is said to be fascinated or bewitched by her, or to put her on a pedestal. Most Americans tend to exaggerate that worship at first; it then is perhaps usually useful—just as a rather violent religious rebirth is needed at first. But no doubt just one such departure from a balance is often so violent as to be damaging. It is much less damaging in any case if its nature is recognized, so that it is consciously made temporary enough to be tolerable, and no ignorant disappointment be afterwards felt because the world no longer runs along at white heat. —— A woman naturally does not have very intense rebirths or worship of her spouse (§170; I am aware that shallow hysterics of the Marie Bashkirtseff sort make-believe considerable tempests-in-a-teapot); so she is in far less danger from rebirths of her own. She is therefore liable to be coy or to "run away" at first in a make believe that causes the man to depart more widely from his balance—in some cases in destructive measure.

f. Thus we have observed M react with W without our explicitly considering W's point of view. Obviously, if M takes both his point of view, and also W's point of view, he truistically takes a monistic view of the restricted standard universe $W..\times M..$, or of the whole universe $W.....\times M.....$. In short, the view becomes ineffable, inexpressible. The essential of Many language and practical life is that we retain a given point of view in any given statement ($A=A$; §22). Obviously, the way to consider W's point of view is to write the formula $M...\times W...$ and repeat the foregoing discussion with W substituted for M. In that case some *quantitative changes would occur*, as a woman W is perceptibly different from a man in numerous *quantitative* ways (§170). But, we can take the point of view of an observer O and note the interaction of M and W thus:- $(W\times M)...\times O....$ That is a very precise logical way of considering it: in actual practice O is a 'temporary personality' of M or W, or one of the dots, which in a so-called impersonal manner observes the two 'usual' personalities (§153k) M and W interact, thus:- $W..(.)\times M..(.)$, in which either of the (.)'s may be O. Then, from the point of view of O, when *both* M and W are *working* to make their dots action that is agreeable to the other (when both M and W are attending to the *agreeableness* of their

activity *to the other*), the conduct is called *cooperation*. Other names for it are reciprocity, mutual helpfulness, team work, partnership. When more than two persons are engaged in that mutually-regarding activity, the combination is called a *democracy*—but I shall not trouble to make the perhaps conventional distinction that cooperation is mutual reaction between two, and democracy, between more than two. —— Obviously, cooperation or democracy is impossible by strict classical logic. For in cooperation each one of the at least two parts of the machine (team) which is working, substantially contains in itself a secondary personality (or structure) that is a duplicate in miniature of the reacting part (and so on in regress), so that the reactions of the reacting parts are known simultaneously with its own actions. And that statement is illogical by classical logic; it is really an assertion that *The Many=The One*—i. e., that upon a given act simultaneous One knowledge of a subsequent act is possible (cf. §150). Or, to put it in everyday terms, we know we can feel our own actions and at the same time feel roughly (inaccurately) how the reactions of our partner will subsequently affect *him*; and we can thus work together. But by the classic logic that is not possible. So we have eliminated such nonsensical logic. But the reader can now see in ultimate detail that it is rather difficult to say precisely what cooperation or democracy is. The race, in its usual manner of being considerably better than it is able to say, by practical trial and error established democracy in a general way before it could recognize democracy well enough to describe it.

g. It is also obvious why it has taken the world so long to decide that it wanted democracy, or even that democracy is right. The universe forces us to apply democracy; no other sort of action is possible, for democracy is merely the action of *That...×This...* in which *That* and *This* are always really identical with each other—their infinite regress of dots in a very few steps being merged into an identity so far as we can definitely perceive. The difficulty the race had in being conscious of that was the difficulty each man has in putting himself in the other man's place, in being sympathetic, or in being what is commonly called unselfish (and the inevitable penalty he pays for such blindness is that he truistically unseeingly blunders into other men or parts of the universe and painfully damages his "skin"; the aristocratic grabber who deliberately shuts his eyes to the damage he is causing usually rapidly becomes so blind to other things that often he hasn't sense enough to dodge such simple things as soft living). We see others suffer or be happy, and that (by the universal *That...×This...* law) causes us in a less degree to suffer or be happy; but then the stupid or rather blind person considers that feeling with nearly sole reference to himself (restricts his vision of the universe or tends to make the zero error—which is the same sort of stupidity as putting out his eyes), or else he with equally bad estimation of measures guesses that he ought to make those others do what would be appropriate action *for him* (thus substantially making the infinity error by jumping to a vague sentimental monism and insisting that the others should have just his feelings, and must do just as he would do—which is what Paul seems to me to have meant by charity or "love" in I Cor., 13; or it is a frequent variety of socialism or uplift; or it is the usual "missionary spirit," or the altruism of the silly Tolstoy or Wilson sort: note that in the typical Wilson case the vague sweet altruism tending to infinity followed the zero talk of perfect neutrality).

h. The aristocrat, "swelled head," egotist, or privileged or protected or mildly selfish or hysterical person, quite frankly sets himself up to be *fixedly* or constantly superior to others. Even the exceedingly stupid extreme socialists or "proletariat" and I.W.W.'s have shown that the idea of that superiority is always present in such people; it psychologically consists simply of the truism that one's self is easier to see, and so on casual or stupid inspection does bulk large. In the development of the brain that aristocratic point of view naturally comes first; it can be observed as a stage in the growth of vigorous children. So that selfish, "superior" point of view determines the older historical forms of government. It similarly determines the "line" or military or ecclesiastical or bureaucratic form of "organization"—they are all essentially the same, there being a "superior" head man and *formally fixed* ranks of "inferiors," in a "line," so to speak (or, in common terms, the buck may and must always be passed down but never up). Obviously, such formally fixed ranks can not possibly *actually* exist, and never do (§§37, 174); in so far as the line or military or bureaucratic or king or pope type of organization is actually what it *ostensibly* is, it simply fails to exist, and hence is in that degree a failure—non-existent (obviously, if in practice any bureaucrat and his line actually tried to pass the responsibility or buck always down they would become unbearably ridiculous in their own eyes; so they naturally use democracy some). That theory or principle is absolute. Even the presumably fixed heads of the extreme line type are not actually fixed or constant (XIX; note the forced abdications of the czar and kaiser). There is no exact or constant science; by the same principle the theory of line organization is wrong. —— In precisely the same way, M can not in principle be the "superior" or "master" of W. Paul's command that wives submit, etc., is in principle absolutely wrong. In the same way there can be no infallibility of the pope, either in actuality or as an official rule; "infallibility" is the same as saying that in some way the pope (or a kaiser, or president of a coal mine) is absolute, and he is not, and can not be made so in any Many sense (Parts One and Two). —— In the same way, Christ as an individual was not a real "Master," or a divine or absolute God; what Christ said can not be applicable to anyone but himself (and is not ultimately correct, even for himself). I judge that Christ did not set himself up as a Master, or an infallible leader, or a superior we must follow (for much evidence of the soundness of that guess, see Singer's "Rival Philosophies of Jesus and Paul"). But if he did, then he obviously was thoroughly wrong verbally. —— In the same way, there can not be any "true" or absolute creed, or any superior, fixed, constant "authority." This book I think tells the truth fairly well for this day; but any man who accepts me for an authority without verifying for himself what he believes of what I say, and taking the responsibility of such belief, is either a fool or a scoundrel, or both. Also, if the race can not in a short time restate the truth considerably better than I state it, then I think the race would be a sorry affair, composed of dubs. Incidentally, practically all fathers and mothers naturally have morals or intelligence enough to want their child to become better than themselves, and more often than not they succeed in making him so. Yet some theologians in bland disregard of such commonsense would have us believe that Christ acted as the dog in the manger and wanted to remain better than we, and "superior," and that he actually was so poor in his work that he failed to help anyone after him to become better than he was. —— And in the same way that all aristocracy is wrong, all *fixed* classes or castes of people are wrong. The actual fact is that no class *is* fixed, and hence any assertion that one is, is untrue, and any attempt to make it completely so is immoral. So truistically, all hereditary titles (i. e., presumably hereditably fixed) are immoral. And all entailed wealth is immoral. And the inheritance of wealth similarly

tends to be immoral, as we shall see (§§168, 173); it would be flatly immoral if it were possible to say just who owned any given thing. (We can properly say, as was done above, that classes, hereditary titles, organizations, etc., are flatly immoral because those are mere formal ways of stating relationships, and a relationship *is* or *is not*; but wealth is a Many thing, and the problem becomes explicitly quantitative and never absolute; footnote 175e.) —— And in the same way, it is immoral to fancy that we have a personal immortal soul (such would be self-contradictorily an absolute Many soul). Some of the foregoing aristocratic immoralities are rather directly derived from the belief in an immortal personal soul or a practical attempt to achieve it in a more or less quantitative fashion. In order to keep this book short I have to omit the glaring historical evidence of how man has suffered from his erroneous belief in personal immortality. —— Thus we see a general statement of the long train of immoralities which result from being aristocratic—seeing our self so well as to let it shut off seeing our neighbor very well—being selfish, in short.

i. The opposite immorality of complete altruism, or of considering our neighbor as practically everything and our self as negligible need not be considered further (except indirectly as socialism, §175). The fact is that such verbal or ostentatious altruism is a make believe for self-glorification in most cases—note Tolstoy's selfishness to his family.

j. Although there is not much of *actual* exaggerated altruism, there is a practical error *nominally* in that altruistic or unselfish direction, which is usually of mild quantitative degree and so not very immoral, but which does destroy some cooperation. There does not seem to be any technical or otherwise "refined" name for it (like other immoralities it instrinsically is not refined; but it isn't yet so bad that we have had to invent euphemisms for it). Primarily it is interfering with another's business—wanting a finger in all pies. It is the reformer's itch—the idea that "if you would only let *me* do it, I could do it so much better." It is butting in —the craze to give advice, or instruction, to establish a censorship, to be didactic, or to act as the traditional autocratic schoolmaster (e. g., Wilson). Of course, avowed aristocrats often act in this nominally helpful, altruistic way: all forms of intemperance, by the principle of rhythm, balance themselves by reversing to the opposite direction, to asceticism, just as the drunkard at times goes on the "water wagon." This butting in is *sentimental* democracy, or a sort of emotional, over-"idealistic," vague effort to get a democracy tomorrow by high-speed, incompetent guessing. The idealistic dreamer does not care to be bothered with working out the hard, distressing practical details, and so is usually densely ignorant of practical methods of getting his large "ideals" applied. That is the general defect of our American efforts at democracy. It is a generous error (provided the butter-in doesn't insist too much on having his own way, or upon grabbing too much lime-light, even to a "place in history")—a mildly exaggeratedly-unselfish one that is a useful relief from too much selfishness, and as a verbal counterbalance to aristocratic talk (such as "too proud to fight," "all the traffic will bear"). It is the same in nature as the American man's idealization of woman (for which I have an apparently ineradicable fondness; so the reader should be on his guard in judging the quantities in my discussion of woman—the theory is simple, and that given is all right). In spite of the fact that we like that defect (we always prefer our errors at the moment, else truistically we would discard them as fast as we can drop the habit of them), it often causes trouble, even though it is useful as a counterbalance to the European aristocratic view of woman as a toy and drudge. —— From another point of view this exaggeration of unselfishness is the result of our looking at the other man and saying that he is our quantitative equal—"as good as I am." But he actually is always either better or worse, just as no two atoms are ever equal. If he actually were our quantitative equal, then the advice which works for us would work for him, and butting in would be moral. We perhaps largely get the habit of butting in from the bombastic Declaration-of Independence, which asserts that all men are free and equal: monistically it is true, but ethics is a Many subject, and ethically it is not true (a matter of ordinary commonsense fact, or as is proved rigorously by Parts One and Two and specifically in XIX); so our efforts to act as if it were true are mildly immoral.

k. Well; that is not nearly so startling as we, in our ritualistic worship of the Declaration, at first fancy. Whenever we stop playing at being Idealists with a very big I, and go to our daily work and forget about being self-conscious "Leaders" of the Wilson and kaiser sort, the majority of us then see that we can not run our job and the other man's too—that being our brother's keeper does not *quantitatively* extend so far as doing his thinking and eating his meals for him. So we then act so as to give him the best chance to run his own job—to react with us, in a team. The best business men of this country clearly have founded their success on the basic principle of helping the other fellow react in his way, democratically—regardless of how much some of them may be considered to have failed to apply that principle to *all* the people. It is exceedingly difficult to apply the principle of democracy to *any* of the people with *perceptible accuracy* ("satisfaction") to both sides, and if we start with a few (instead of lazily slumping to a defective-brain aristocracy:- "me over all" in one direction, or socialism [§175] in the other), there is hope that a few of us can grow big enough to apply it to all. Ford probably manages to please most of his customers, dealers, employes, and himself; but I understand that some of his competitors do not think he is democratic, and like the socialists want the automobile business divided equally between the able makers and the dubs. —— In our simple case of $W...\times M...$, M is obviously cooperating with W when he attends to *her actual ability* to react—*works* so that she can act in *her* best way—without her having M as a dictator, or other verbally-unselfish Leader of The People. In order that M may be able to work that way he has to be able to see that W is *not* his quantitative equal so that she can not be expected by him to react to his acts as *he* would to such acts. He must have the really good observing ability, mostly lacking in the socialists and autocrats, of seeing what W quantitatively is, and hence how she can best react, and letting her react that way, and expecting her to, and anticipating such action. That is all hard to do. Obviously, all acts of M and W interfere with each other somewhat—there can be no perfect judgment and adjustment of them. So the object of M and W is to work together as accurately as possible in a series of cycles. Truistically, if either fails to act democratically the algebraic sum of the cycles of at least one of them (other things staying fairly steady) accumulates in one direction, and there is an explosion of some degree—*perceptible* conflict; there is conflict in an imperceptible degree, or incompatibility, as soon as one of the team stops *trying*, when *working* (cf. par. m), to make his or her reactions fit with the other's best abilities. And all that is the complete principle (in one of its indefinite number of forms of expression) of the labor-capital problem. Capital has intelligence enough to see that it is to its advantage to *try* to cooperate with labor; hence there need be no conflict on the capital side—which helps some, and delays the explosions. But although most workmen intrinsically have ample

intelligence to see that it is to their interests, both financial and in mental comfort and contentment, to cooperate, it is not to the *immediate* interest of the labor leaders to have industrial peace (for the same reasons that petty kings of an olden day started fights). In the long run it would pay the leaders to cooperate; but they have untrained brains, and most of them can't see that. And it seems that, like the subjects of olden kings, most workmen have not the intelligence to handle that more complicated problem of making their leaders see. So it is likely that for some time labor in general will not try to cooperate, and there will be conflict on the labor side. The practical solution obviously is for capital to try to show labor in general the facts, and to try to get the labor leaders in particular to see those facts. Some of the more autocratic leaders will perhaps require legal treatment by psychiatrists. —— In the same way we can react cooperatively with "material" things instead of with another person—have the formula *Material things...* × *The man M...*, or *Material things...* × *Ourselves...*. If we use those material things or react with them with some intelligence as to how *they* can react, and will last, can be replaced, will not be wasted, etc., such 'material democracy' is called *conservation* in economics, and by more familiar names in business. Any stupid use of material things is waste:- 'material aristocracy.' One of the conspicuous characteristics of aristocrats is that they are wasters—partly deliberately so in order to exhibit their mental defect, aristocracy, to the world, but largely because they prefer to loaf rather than to acquire sense enough to make a balanced use of things. The confirmed manual laborer has the highest pecentage of waste (except paupers and criminals and insane). E. g., he has an idea, vaguely but often vociferously expressed, that he is the only worker (that only more or less direct manual labor is work), stupidly overlooking the fact that he left school, and refuses mental work or study, because he found that to be too hard work for him; thus, simply because he won't do the work required, he wastes his opportunities and a large part of his life. —— The summary of this and the last paragraph is that we should, as a demonstrated moral principle, try to pay others fully and in carefully precise measure for what they do for us; *and* we should, instead of indulging in wordy sentimentality about altruism, be careful that others pay us in just measure for what we do for them. It is immoral to fail to pay; it is equally immoral to fail to get our money's worth. Actually, the universe is exactly balanced all the the time (§114c): ultimately, the universe does not "keep books" or "extend credit." And it is merely a truism that the most moral life most widely 'sees' or gets that balance.

l. The last paragraph is a mathematically definite statement of democracy. Truistically, we can never achieve a perfect democracy: it involves the infinite regress, and we must be continually guessing at the dots or quantities. We see that a basic requisite for the practice of democracy is to "size up" the other man *as he is*—not to take men as quantitatively equal. So it is again obvious (see §164bc) that *the fundamental practical need in being moral* (in doing anything right—in being "successful") *is to make a fairly accurate quantitative judgment of ourselves, others, and things.* There is nothing very novel about that conclusion; it is merely a specific statement of Socrates's "know thyself," or of the general object of science. Nearly everybody tacity accepts that conclusion in practice, and primarily tries to estimate himself and others. All personal gossip consists of making such estimates; even the astronomer figures his "personal equation." Most of what we call news is personal gossip. And in spite of the beratings we receive from those butters-in who urge us to "higher things," we keep on with personal gossip. And we are profoundly right. As there is no exact science we can never be accurate about men. But even when a physicist measures the length of a standard yard his measure is a series of personal opinions as to just when two marks coincide. If we indulge in personal gossip with consciousness of why we are doing so, and of what we want (a mutual comparison and checking of values, and training in estimating persons), we are acting very morally.

m. If M can with reasonable accuracy estimate W's characteristics, then, and only then, can he consciously *trust* her and thus be able consciously to rely on her reactions, so that he can at times let her take the load of responsibility of running things while he rests, or goes the other way in his cycle. That is an essential part of democracy. But the only conscious phrase we have for it, so far as I can find, is "In God we trust"—and as will appear, we usually do not know what it means. —— The aristocrat fancies that he is *always* superior, always on duty and strained away from the balance in that direction, that he is "personally" indispensable, that the dear people can't get along without him; for according to his dualistic theory there is no one available to react with him on a formal equality. In the practically pathological case of aristocracy of the late kaiser, we see him substantially taking on the theoretically unceasing infinite burden of instructing Gott what to do. But in the democracy of M and W, if M really trusts W, first he can do his work, and then so to speak abandon himself to her, and rest himself while she takes up the tension of the proper and expected reaction. He can do his work: *and then rest* (go through the other part of his cycle) "without a care"—with an actual conscious temporary lack of responsibility. *Theoretically, in no other way except that general democratic way can he actually rest.* (Also, truistically a man can never have *all* his parts simultaneously resting, nor any one organ absolutely resting: for brevity I omit such precision below—such explicit inclusion of the infinite regress of democratic action.) In theory it is not possible for a person in a line organization or bureaucracy to rest; for in "principle" there he must always carry the burden of his rank or duty. When anyone gets the idea that he must maintain his rank or his "awful" responsibility or "dignity" or "position," that he is the fixed boss or "leader," then in his *conscious* pseudo theory he misses moral democratic living and *can not rest.* Of course it is impossible that he actually stay in just that one side of the cycle; after he unduly fatigues himself with his silly beliefs, nature (the rest of the universe) makes him rest—blowing up his brain to do it if he is too stubborn, or killing him. But probably there are numbers of people who have never consciously and willingly slacked up the tension of being an aristocrat (the tension of *conflict* in par. k) and been a conscious democrat—rested, had *peace.* When we trust God we actually, in Many or practical life, estimate or judge that all the things, including people, directly concerned, take on the responsibility of reacting while we rest. Every time we go to sleep we have thus trusted God; and when we get insomnia we haven't. An aristocrat often can not be consciously democratic enough to trust the part of God which is his wife as far as she deserves—much less the "people" he condescends to "lead," or the employer whose wishes he tolerates. —— This paragraph states the ultimate application of religious experience in daily life. If the reader has not had conscious experience of such a last step in democracy he may think it queer that this paragraph means anything in particular. But if he keeps on trying to understand it he may see its great importance. Anyone who fails to act on the principle stated will in due time be dealt some painful but just reactions by nature. A few years ago a notoriously

autocratic financial pirate died in a long-drawn-out quivering fear—a truistically "natural" reaction conventionally named poetic justice. A fairly intelligent person would consider that a high price to pay for the "privilege" of aristocratically grabbing wealth—especially when it is noticed that that pathological condition was merely the explosion of years of fear. Nature finds no least difficulty in extracting millions of dollars worth of payment in pain from the profiteering boob who thinks he can run the game by his silly rules.

n. I do not urge or beg anybody to trust God, or find rest in God—or more practically, in his wife, or friends. I merely point out the fact that everybody does actually trust God, and does so by trusting, knowing, the people and things nearest him. If he observes that fact, becomes conscious of it, he thus gains more life and happiness, because he can *consciously* rest. Complete morality not only implies life more abundantly or wider activity with economy of time, but it also implies the other side of the cycle:- rest, or peace. Democracy includes both activity and peace. The man who whines of a "heavy burden" is not religious, not a democrat.

§168. a. We now consider some conventional ethical names for the reactions of ourselves with a wider environment of persons and things than the *W...×M...* in the last section. —— We have seen that in general we get the important things of life by acting cyclically with our environment—the important thing is the consciousness, and hence enjoyment, of those cycles. There are a number of ways of naming or recognizing such consciousness—of estimating or asserting what we call the *worth* or *value* of certain activities. We consider worth, or value, in this section. It will become implicitly an obvious truism that all worths or values are identical; so I shall make no effort to separate "material" and "spiritual" values (that is already covered by §161—we seeing that hedonism and idealism are essentially the same). The term *value* usually has a relationship meaning—is a God the Holy Ghost or "abstract." So it is often confused.

b. If M and W cooperate in *W...×M...*, the result, from the point of view of *naming* values (which names or values here become Many terms), is ordinarily tacitly this:- *Love...×Work, or worship, or loyalty...=Happiness.* That equation looks queer because we probably use the factors more often as relationship words; if we write *W...×M...* with such words used conventionally as relationships to replace (§30e) the ×, we may write, *W...(love, work, worship, loyalty, or* PAYMENT *in any material or spiritual way)M...*, in which those various *values* definitely name the general ×. Those values *relate* any *That...* and *This...*, and apply or act 'both ways,' so to speak. I. e., in an ultimate sense any reaction of *Other men...×Given men...* implies that *each* factor is "paid" by the existence of the relationship symbolized by the ×,—the relationship necessarily going in *both* directions, *to* each set of men, or being ultimately circular. (That is the explicit ethical or economic form of the truism of existence, §22.) But in humanics we usually name the values differently for each of the two directions of relationship, thus:- *Employes...* { *Labor* → / ← *Wages* } *Employer....* That difference in names is an implicit commonsense recognition of the fact that no finite cycle may be *exactly* reversed (Index, "Cycle"), and is the same as the theory of direction of reaction in thermochemistry. We may write *W...×M...* in terms of value:- *W...* { *Love*→ / ←*Love* } *M...* ; or the democratic formula, thus:- *Other men and things...* { *Reaction*→ / ←*Action* } *Given men....* The love W gives to M is quantitatively different from the love M gives to W; in the same way the quantities or measures on the two sides of the relationship in the democratic formula are not identical, which agrees with the last section. (Basicly, that is the principle of incommensurability; §50.)

c. The last paragraph gives the theory of values explicitly and rigorously. The volumes of its expansion are mostly omitted at this point, there being below merely a few general suggestions as to that expansion. I shall use values mostly as Many terms, as that is more definite and simple.

d. The general value-equation is obviously:- *Fame or money...×Work, or worship, or loyalty, or service...=Happiness.* In short, we name the reaction to our activity:- *fame* (good repute, honor, respect of the community, "face," etc.), or *money* (wealth, or any material or other thing which we agree to let money symbolize). If we acted and could perceive no reaction, then truistically we would not be able to know that we acted, and so would be in a monistic Nirvana —or, in Many life, would stop acting, and be dead. So, as ultimate truism, we are 'paid' for all our actions; the important things of life are *measured* by those payments, or are *made perceptible to us* by them (that statement substantially makes payments into relationships, though our formula is using them as Many terms). Of course, we can and do make a standard universe of our skin-bounded self, and get numerous reactions or much pay *as* the reflected emotions which follow each act of will. If we act morally we truistically get such reactions—as sense of well-doing, peaceful conscience, "virtue is its own reward." But if we "deceive ourselves," lie, suppress the truth, or fail to react fully to things, prostitute our brains by pretending to believe self-contradictory theology and other inconsistent stuff, *refuse to see or admit our mistakes*, or otherwise act in an aristocratic manner, it is obvious that we shall primarily cut down those reactions that are emotions, and deprive ourselves of some happiness. In short, the punishment of the liar, profiteer, or other sort of aristocrat, is that he 'contradicts' or opposes his *own* nervous system until it fails to act, so that it partly dies—or "comes to believe his own lies," or commits piecemeal suicide by stupidity. The liar can often deceive other men into making payments to him that are too great for the *work* he did; but obviously the liar pays for such 'over-payments' by partly destroying himself with the lie—literally takes it out of his own skin. And the persons who were so foolish as to let themselves be deceived by the liar get the rest of their money's worth by being painfully partially destroyed as an automatic lesson (which even an idiot will consciously or morally profit by if accumulated enough) to observe actual facts for themselves when they are of direct importance (and not be easy marks or boobs that furnish a constant temptation to vigorous men to become exploiters). —— It is therefore directly obvious (and in agreement with our total argument), that it makes no difference *in principle* whether we measure morality by 'inner' or by 'outer' payments—by spiritual or by material measures (§§167k, 114c). Obviously, the temperate and most moral man balances the two sorts of measures, circularly, so that each serves as a check or measure on the other. Clearly, the man who "Idealistically" professes to think that there is nothing of appreciable value outside his skin in the "material" world is a trifle insane—as is his brother crank who "Scientifically" fancies his nervous system is a vacuum as to *Emotions...*. So for brevity I pay no explicit attention to whether value is inner or outer, but tacitly include both.

e. Whether we are conscious of the fact or not, we measure our happiness by fame and-or money. We may work for our own approval, in which case we have fame as inner self-respect or self-love. Some people claim they want only that (e. g., all highbrows and "Artists," etc., who talk of "art for art's sake," "knowledge for knowledge's

sake," etc., ad nauseam). Clearly, such talk is equivalent to the dualistic assertion that their skin-bounded self is the universe or God, which is so obviously wrong that it shows that those "Artists" are make-believing that they are successes—talking as if ordinary outer fame, especially money, were sour grapes. But, though inner fame may be thus exaggerated, *some* is essential; e. g., all initiative is the result of anticipating to ourselves that a certain action which people do not know they want (or which they even emphatically deny they want when they first see it—as, for instance, sometimes happens to this book), will first please us, while we wait for their later approval and their then giving to us praise and-or money. In such initiative we have to take a chance on being right. And while we normally value the inner self-respect some, *we also by ordinary commonsense want that confirmed* (§171jk)—which is proved by the fact that the promoter charges high prices for his services:- he has to take a chance that he is right, and has seen better than practically all other people in a certain detail; usually he is wrong, and gets negative instead of positive pay.

f. And just as there is a normal limit of extent of activity (Fig. 163b), so there is a limit beyond which either having fame-money, or the effort (ambition) to get it, is painful and immoral. Fame-money is the *re*-action. Clearly, when we *work or play* we should *primarily have our attention* on getting *our* acts performed: we are at the time not directly concerned with fame-money or payment, but are concerned with sending our energy or '*pre*-payment' in the contrary direction. So it is truistic that if we get too much fame-money, or if we attend to getting pay primarily, or exaggerate pay by collecting all the traffic will bear or "the value of the service" (i. e., use a practical monopoly to gouge the other fellow until he is pained into legal rate making—an evil to everybody, but one which inevitably follows such gouging), then we must take or have taken our attention in some degree off the work or play and naturally do it unsatisfactorily.

g. Only by *primarily* attending to getting fame-money is it likely that we shall get more than is good for us (the only other way of getting too much that is at all common is by inheritance). And although the direct effort to get fame-money is wrong (just as the negative aspect of it, rate fixing, is wrong), an indirect or secondary effort to get it is essential. I. e., in our resting half of the cycles we should observe whether we get it or not; and if we do not get it, then we must come to one or both of these conclusions:- (1) our act was rather worthless to others; i. e., is "wrong"; (2) the other persons' reaction or pay is wrong. Then we must indirectly go after fame-money by modifying our future action. And that obviously is another way of stating democracy, but I need not repeat the details in those new terms. —— We may note the reverse aspect of that:- We should examine at times the fame-money we are getting to see if it is actual, and examine the people who pay it to see if they are moral in awarding it (to see mostly whether they are competent to judge whether they are getting their money's worth). In short, we are morally bound to examine the gift horse and the donor. Willingly or appreciatively to receive praise or money (particularly a "tip") from an aristocrat for any service other than such service as a defective may estimate fairly well is to make oneself an aristocrat in some measure. E. g., a grocer may safely give an aristocrat a standard food and willingly receive the standard price (maybe not in the present disordered market); but if the late kaiser were to approve my remarks on ethics, I should promptly begin to try to find out why. Or, if a child of ten said that this book was fine, I should value his good will towards me, but would not think his judgment of the present form of expression of much value (though he could easily judge the book when put in his language). But I would value the general judgment of this book by the average college student of twenty, as being considerably more competent in my opinion than that of the pope, or the average lawyer or theologian or business gambler, or of practically any radical or materialist. —— To be more specific about the foregoing generally stated principles:- The practice of tipping is a mildly aristocratic one, which however damages democracy by its extensiveness—being a training school of economic and ethical vice. A man gives a waiter a dollar, and expects the waiter to judge him to be "superior" —to return the money in measures of fame, good repute. (That is the case when the tip is willingly given; in the case where we are forced to tip or suffer worse consequences, it is in a mild degree blackmail.) The essential character of a tip is that it is money paid which is over the price that it was implicitly contracted to pay for a certain thing; so truistically the only way the receiver of the tip can pay for it (all things must be paid for; §114c) is to give fame to the giver (for otherwise, the receiver implicitly says that the service which he was implicitly under contract to give was to be an inferior and careless sort—which even by such coarse morals and economics as the legal law is equivalent to his breaking the contract). That reaction (of the receiver giving fame to the donor) *could* be moral; but in practice the pay for the tip which the tipper gets (when it isn't blackmail paying for the tolerable performance of a contract otherwise paid for) is almost necessarily a cheap, dishonest sort of fame; for the receiver obviously ordinarily has not data enough on which to form a reliable judgment. And that amounts to debasing personally the receiver of the tip—amounts to his admitting that he belongs to a class which is essentially inferior; and to his saying that he will sell his opinions even when he can not properly form them (which truistically is some destruction of his self-respect). Also, the donor is debased by willingly receiving such servile abasement—even paying for it and thus showing that he thinks it a fine thing which he himself is willing to do when the tip is a bit larger (or else uncomfortably shows himself and others that he is weak in some degree by submitting to such minor blackmail). —— Obviously, in order to be very precise about the principles of tipping this should be extended to several pages. A sufficient practical proof of the truth of the above rough quantitative statements is that a self-respecting person does not take tips. Also, the best business men will not tolerate tips; e. g., Filene does not permit his employes to accept tips, and his employes are usually not the sort who would debase themselves to get them. —— The intelligent reader I believe will agree that I display a proper sense of proportion in giving a half dozen lines to showing the principles of the "large and important" subjects of monopoly pricefixing, rate making and regulation, etc., and dozens of lines to tipping. If our very children have their innate honesty or sense of correct price principles warped and distorted by such common practice as tipping, we had better talk in their terms of cents, as the same simple principles apply in "large" terms of millions. I try always to "begin at the beginning."

h. Money (or any other material thing) is obviously a part, and hence a symbol, of the total universe or God, and hence of our "real" selves or souls, considering them monistically. And ultimately, real value is relationship (pars. ab) —or in human terms is love. We really ultimately do everything for love—which from usual points of view is named fame, good repute, honor, respect, recognition, "face" by the Chinese, etc. But that love can be expressed definitely only by symbols of the Many (Part One)—to express love or give payment is again the problem of the One and Many.

We give another person love or actual value in a Many or practical or everyday way *only* when we give him some of our lives or activity in terms of *L* and *T*. We can not *absolutely* give another person such Many love (for absolutely, love is inseparable, and he already has our love); the giving of it is merely symbolical—involves *L* and *T*. So truistically, any part of the universe may be used to symbolize or measure that part of our life we give to another. By ordinary convenient agreement we select a part that is as durable as possible, which as a small and hence easily transported unit represents considerable human work in its original production and as nearly as possible a steady (and preferably equal) amount of actual work to *re*produce at later times; a part which is homogeneous, readily dividable, and readily recognizable as itself and not a similar substitute, and which has an actual usefulness or intrinsic value as a "raw" material in industry. Such a standard Many part is usually what is actually meant by a unit of "*money*"; and the best substance yet found to meet those truistic requirements is gold (for details see "Ency. Brit.," "Money," or modern economic texts). The essential characteristic that would make a part of the universe a unit of *absolute* money (a *constant* for the measurement and-or relating ["exchange" is the technical term] of human life or work, like physics's exact constants) is its acceptability as a symbol of a constant unit amount of life by everybody on sight, without question, at any time—so that the unit symbol has an "absolute market." There obviously can be no such absolute money—no exact science. *If* we could rely on a person's promise to give a unit of life on demand, and could agree and stay agreed on what a unit is, money would be unnecessary—a nuisance. But men's brains are entirely too lacking in steadiness or durability, from many obvious causes of which dishonesty is but a trifling one. So we need a durable symbol of a man's brain condition at any given time, and the barter of *any* Many parts as such has disadvantages (see "Ency."). And obviously, if gold is agreed to be money, then anything else by logic, form, or agreement is absolutely not money; and, dropping the agreement, then by physics, anything less enduring, steady, and certain than gold is in a less degree available as a money. A simple promise to pay is not money, but is the real thing (relationship, love, "credit") which money is used to symbolize. The equation is:- *Parts of human life, or Human effort or work, or its Products...(←Credit→)Money [actual physical parts, such as units of gold, apart from agreements]...=Standard or whole universes of living, or Certain transaction, or the sum of Money where it is the agreed-upon standard.* The principles of money are obviously the solution of the One and Many. The usual befuddlement about money, from which comes most financial panics, etc., consists in or arises from confusing money and credit (cf. footnote 28h). That covers the principles, but some practical details of money are in the footnote.[168h]

[168h] i. The meaning of the proverb that money (or love of money) is the root of all evil is that questions of money are the practical ways of stating the problem of the One and Many, and obviously lies in two practical difficulties we have with money:- (1) the standard unit of money or *Money*... constantly changes with reference to what it "buys" or evaluates (that change is commonly implied by the phrase "high cost of living," and is the economic form of the law mass varies with velocity, and is practically due to the fact that the truistic requirements of a good money are imperfectly met by all substances, gold in particular having been rather continually relatively easier to produce for some centuries); and (2) the psychological or human nature aspects of the same difficulty, which we may consider under two heads:- (i) when men do agree that (say) gold is money they rarely stick to the agreement but actually try to make the absolute error of having credit money (we consider that below); (ii) it is so hard justly to measure human acts in terms of money (the Supreme court practically gave up the problem of saying what is "fair value") that people have often made the One assertion that life can not be measured, and so have refused to try to use money consistently except as a measure of the most concrete things (e. g., aristocrats for centuries have substituted more or less careless tips and "patronage" for definite and considered payments). The more precise statement of that proverb is that the root of all evil is the dualist's stupid effort to get something for nothing—to get something for too little payment; to get something for one of his "kind" words or careless promises, which he thinks costs him nothing, but which when insincere costs him (truistically destroys) a part of his nervous system. So the sentimentalist's objections to such a "vulgar," "material" thing as money are practically invariably the aristocratic effort to get a "privilege" (to get something for nothing); or else his objections are more or less thoughtless parrotings of the aristocrat's objections. As a practical rule, when anyone is so "refined" that he avoids mentioning the precise price he wants for something, it can usually be correctly judged that he intends to try to get a money price that he himself, at least subconsciously, thinks is more than the buyer should pay.

ii. Those practical difficulties with money can easily be *theoretically* obviated. The natural or truistic law that the unit of economic mass, say the gold in one dollar, varies [in value] with velocity may be analyzed into two practical parts:- (1) that a unit of gold measures, originally or as a *nominal static* measure (the 'nominal' means that we neglect in economics the fact that the physics mass of that gold itself varies with physics velocity; the *economic* law mass varies with velocity is a higher order of the physics law, as I had to indicate by the bracketed phrase in line 3 of this paragraph) the amount of average human effort or life (love) required to extract it from the environment; and then (2) that its continuing or *dynamic* value after that depends upon the cost in effort at which it can be passed from buyer to seller, and the average effort required at that particular time to extract a similar dollar from the environment. I. e., the gold unit "wears out" (is partly lost) on passing, requires effort to care for and pass, requires effort to recognize, requires even more effort in case a symbol of the symbol gold is used to "recognize" or verify that *actual gold* is represented and may be had (but in theory, though not so in present practice, as implicitly appears, the greater effort in recognizing that *secondary* symbol is more than compensated for by savings in not having to move the actual gold; see textbooks for details); also, with increasing knowledge, so far a new unit of gold can be produced with usually less effort. Obviously, those things (which I have so roughly stated as to cause some expert economists to tear their hair—but I shall keep on endangering hair in order to get essentials clear of the numerous details that litter up men's minds)—those things truistically cause the gold dollar to vary in value—in the amount of human effort it pays for. And in theory, all we have to do to make a gold dollar constant in value is to compute those changes and apply a suitable correction at any one or more of the infinite "number" of steps in the process. We note below some suggested ways. Of course those variations are in infinite regress, and can not be in a finite time accurately provided for. But the worst objection to that theoretical stabilization of the *gold dollar* is that it doesn't touch the worst difficulty with finances:- that after agreeing on a dollar we then try to make the absolute error of abolishing it (by using credit or relationship direct, instead of that Many money). Of course, we could also undertake to include in the computations an estimate of how far we shall daily succeed in throwing away our money unit. But it is much easier to decide whether we want a money or not and then exhibit a little elementary intelligence by sticking to it—sticking to $A=A$ financially and morally (§22).

iii. If *promises* of possible gold (in some degree representing actual gold. and the rest credit—what we shall call *fictitious* money, as it is partly pure fiction), such as printed notes of any sort which do not actually represent 100 per cent gold, pass so rapidly or in such volume as to show clearly to most people that the actual gold does not exist, the value of the fictitious money truistically decreases—such money becoming worth only the fraction or per cent of its face value that represents actual gold. If the bearer of the fictitious money is fairly sure he can in time get the actual gold, the value of his "money" will perhaps lack something of decreasing that much if he can compute how much interest he may lose. But it is truistically impossible on the average to keep the value of such fictitious money above the human effort it *in fact* represents. I. e., in plain language, if we have a 40 per cent gold reserve, in the long run our fictitious money issued against that will theoretically be worth

i. So in a fairly civilized or moral society, money will serve as a roughly accurate measure or symbol of all values. Words of love, or fame, will constitue a "spiritual" symbol, and at the same time a proportionate measure of money will be given as a "material" symbol, for each work or service.

Obviously, then words will begin to have a definite conscious value. As it is now, the customary opinion is that "mere words" are practically valueless: "talk is cheap." It is the most expensive thing there is; but the fact is that by the classic logic, and in practice when used by aristocrats or dualists, words *are* unreliable and nearly valueless to us except as showing how not to use them. The selfishness or stupidity of the aristocrats, which makes them unable to say $A=A$ with a dollar and stick to it, also makes their words in practice unreliable and unstable, and has considerably dislocated all measures of humans. But that unreliability with words obviously costs the aristocrat some destruction of himself: he pays in pain and in loss of some of his life for what he spoils —his selfishness and get-rich-quick schemes with words as well as money are simply stupidity or ignorance:- he pays for them, and pays much more than an intelligent person cares to pay. But words have thus been debased so much that now neither what a man says nor the word of praise or censure which he is awarded for it is regarded as of much consequence unless definitely accompanied by money measurement. It is right in principle that money can measure any kind of value. Money actually does talk—honestly and definitely (except the part that is water). Even the aristocrats' money talks far more honestly than their words do—for they vary the value of their words infinitely and they can't juggle gold so violently. Words ought to talk much more precisely than money does; the present greater reliability of money will help to rehabilitate words if both are used consciously and consistently. —— Those principles practically show the average characteristics of government officials and other persons who occupy *nominally* important positions—who have more title than work, like the imposingly gaudy doorman of

40 per cent of its face value (a little less in fact, to provide for cost of printing it, etc.). That is a simple truism, and inescapable: the fictitious money is 40 per cent money and 60 per cent not money but credit, and nothing can change that fact; the credit may be good, and worth nearly its face value, in which case the gold miner exchanges his gold for the fictitious money with but a slight loss from the nominal pay he gets for producing it; but just now in this country it costs about an average of $1.50 of presumable gold to produce $1 actual gold (probably most of the loss of gold producers is hidden in the long run as underpayments for their improvements in method). And truistically everybody who accepts the fictitious money is gambling, and in fact does not know what actual gold is worth in terms of (say) food (a fact that is glaringly true just now, and always at rhythmic intervals with fictitious or "watered" currency). I. e., when there is fictitious money all actual money truistically ceases to exist; or, we have destroyed the unit of money we agreed on (by asserting that credit is money, when in fact it is not—although credit is absolutely indispensable: it merely should be correctly named); the gold still exists of course, but is no longer a standard of money, but merely partial security of often widely fluctuating value; or, in technical economic terms, Gresham's law (good money drives out poor: people keep the poor, and circulate, give to their neighbors, any legal money which is nominally but not actually worth so much) —Gresham's law goes to the limit, and the nation possesses *no* actual money, but merely printed promises, hopes, dreams, "blue sky," or what not—you accept some of such money, and become a creditor (not an owner), and by the inevitableness of facts have to figure on what you will lose if you keep it long enough to give somebody a chance to fail to pay. And that that is true practically is proved by the notorious facts about panics, "reserves," etc.

iv. This country, in spite of repeated resulting disasters called panics (we are in one now—a long-drawn-out sort—the change from our customary rapid panics being due to certain features of the new banking laws: the Roman empire got in the habit of having our new sort, and naturally there shortly wasn't any Roman empire)—our country issues all sorts of things which look like real money but which are pure-money-substitutes and actually fictitious—so that by what we may call the ultimate Gresham's law, which works by facts and not by congressional fiats, we usually have no actual money at all, but a governmentally conducted credit system or bank, run by people who are often densely ignorant of money or the One and the Many, and who are mostly financially irresponsible for results. No man and no government can possibly make fictitious money real money, because truistically it is not. To issue fictitious money which looks like real money, and is intended to, is obviously the same sort of stupid dishonesty as mislabeling and adulterating our own food and expecting it to fool our digestive apparatus.

v. We saw in the text that there are a number of practical or perceptible reasons why an actual gold dollar varies in value, and that like any other unit of the Many it varies in infinite regress in value—in relation to, buying power of, reaction with, any other thing or set of things. Irving Fisher has shown that the unit of value can be stabilized by varying from time to time the weight of gold in a dollar to correspond with the variations in work required to get gold and the other usual needs of life. Obviously, if the work required to get such a variable unit of gold thus varies precisely as does the work required to get other needs, the value of the dollar truistically does not vary for those other needs, and insofar as that stabilization is accurate a dollar may be accepted as a steady unit. Fisher gives a good short statement of the practical proof and details of it in "American Problems in Reconstruction" (Friedman, editor), (and he has a book, "Stabilizing the Dollar," which I have not read; I don't know whether he proposes to stabilize the fictitious or the actual dollar). (Other methods of stabilization have been proposed in the past which are ultimately identical with Fisher's, are theoretically as sound, and have more or less the same practical objections; two are mentioned on p. 227, Gide's "Pol. Economy" [2nd Am. ed.], one of which is to water the currency—issue fictitious money—in amounts as are needed to correct the varying gold value; my §123 implicitly shows one way of stabilizing the dollar—and the unfortunate results of a *too* stable dollar in such a millennium.) As noticed before, Fisher's method can't accurately stabilize the dollar, as it deals with the infinite regress (his method is substantially the economic equivalent of Einstein's theory, §66, with a jelly-fish dollar—financial papers call it the dancing dollar). But although that theoretical difficulty is readily obviated in the same way that we live in everyday life, it includes two practical difficulties (in addition to that of guessing how much the next congress will water the currency), that make the stabilization in my *guess* undesirable:- (1) It is impossible to change even nominally the weight of a gold dollar continuously; it can be changed practically only occasionally, and the intervening time intervals will allow unequaled opportunities for grafting, "leaks," and almost sure-thing gambling at the expense of the government (I have seen an analogous thing done). (2) But the worst defect of such stabilization is that substantially all the people of the world would have to accept the gold standard and change the weight of the unit simultaneously and equally to make the method safe. If they did not and just the United States stabilized the dollar as far as was practically possible, then truistically we would be forced to buy or sell all the gold supplied or demanded by the other peoples with their different units (theoretically the present more or less natural laws of foreign exchange would prevent that; but practically they wouldn't, for the simple reason that our unit would move in *appreciable* steps—or if the changes were arbitrarily restricted to stop that, then we would have a fictitious stabilization superimposed on a fictitious money, a double attempt to say $A=A$ and A *is not*$=A$ identical with our "free-silver" stupidities). It is doubtful if we have *enough* gold and other commodities thus to meet such world supply and demand and thus stabilize it at our unit. We might be able to do it successfully materially; but the psychological side then comes in, to the effect that it would put a terrific strain on the honesty of some men (to say nothing of the worse strain on their intellectual knowledge of prices), so that if those men crumpled our condition would be far worse than now. In our present state, if all men were fair minded there truistically would be no painful price variations except as a result of intellectual ignorance as to what are fair prices (inability to gauge supply and demand); and in our present state no great temptation to gouge is ordinarily loaded on one man, so that all but the few defectives are fairly honest; also, now the majority tries to work out what are fair prices, and the intellectual result is sure to be far more accurate than the guesses of the wisest, best informed stabilizing committee. That present state, I judge, is preferable; further, for most of the people to be engaged perforce in often estimating values—even concrete money prices—is the best of educations, and a paternalistic stabilizing board, or any sort of rate making commission in theory deprives them of such real living. There are flabby minded people who would be glad of such an excuse to avoid more of the work or really vigorous life of getting their money's worth; they sit in apathetic, half-dead sloth and yelp like a whipped puppy to the government to protect them from foreign or some other sort of competition, from the middleman, or, in short, from having to live. They need a nurse—not a government.

vi. So it appears that besides some ordinary self-reliant work, the practical thing we need financially is an actual dollar—a Many

a department store. Such persons chiefly get fame as pay: and that is largely what they work for. And as just noticed, fame unaccompanied by, or unmeasured in terms of, money is an unreliable guide. In a business, ordinarily the money profits are a reliable measure of the worth of the fame received; the pompous business title-bearer works for casual words of fame, doesn't do much work *for the business*, and so profits fail, and in the end he loses his job and has acquired ill fame as a final result of that failure to make money. But obviously, in politics, as ordinarily viewed, there is no such money check, and the fame which is worked for is unreliable. Or it is even worse than that:- a government official is often given money-measured fame for the money he takes from the whole people and gives as nearly gratis as possible to his fame-bringers—is rewarded in the degree he succeeds in financially ruining the country. So truistically the average official tends to be irresponsible and incompetent and more interested in attending to getting fame for himself (note the plethoric plethoricalness of their speeches) than to working for the government, the whole people. —— There is no general remedy except education—especially in sizing up men, and in considered, careful use of words in praising the able officials. There are one or two minor practical helps which are obvious:- As the business of government, in terms of money, is to *spend* money for the greatest good of the greatest number, then the available money check consists in rating the success of government officials by the *smallness* of the percentage taxes are of peoples' total income; if they can buy mental and material improvements with double the sum of taxes which triple the people's income, they have been highly successful. My rough guess is that we pay about 25 (twenty-five) per cent of our incomes, if not more, for government (federal and state and county, etc.), and that a fair business man could supply better for 5 (five) per cent. Of course that guess includes an estimate of actual cost of indirect taxes: good officials would have to abolish those (they are immoral on other grounds; §176d), in order to permit themselves to be judged by a reliable money standard. And, as there is no definite money check on him, the good official will exhibit both good taste and ordinary fairness by endeavoring to keep the government from engaging in business, or from interfering *specifically* in any private business, except to restrain defective individuals from violating general laws. —— Other details are given in appropriate places.

j. It also follows that in principle Taylor's doctrine of scientific management (expressed briefly in "The Principles of Scientific Management") is perhaps the most explicit and extensive advance in ethics or the science of living that has been made since Christ (§163j). Taylor required (1) cooperation or democracy, as it has been explicitly described above. That basic conscious human Many "machine" or loving society is then (2) to be maintained in a delicately adjusted balance by careful and explicitly conscious measuring of its reactions—by a deliberate application of "science" or measuring to humanics, *with a conscious economy of time.* Obviously, only such a continually adjusted human machine is the maximum democracy or maximum life—Taylor had no get-rick-quick scheme or hocus-pocus panacea, but would definitely measure and consider each quantitative or Many problem in accordance with its perceptible facts—a glaring exhibition of commonsense that has irritated the shirks, sentimentalists, quacks, and bright wonder-workers and "system" mongers ever since (we have "systems" in business now, instead of in philosophy; the philosophers have learned better). And then, as the final general principle, Taylor showed (3) that a definite money value could be given a democratic reaction; and that the *actual use* of such a symbol or measure did give all the theoretical benefits of democracy —in definite practice did give life more abundantly. Of course, Taylor's work is so extraordinarily extensive that it has been perverted by some smaller men, and labor in general has not had enough intelligence to grasp it. Ostwald, for instance, took it up and perverted it considerably, to fit and agree with the pre-war German materialistic idea of "efficiency," which bids fair to make the word *efficiency* join the word *pious*. —— Taylor was a supremely great man. He was a democrat more beautifully balanced than Lincoln. There is no space to go into much further explicit detail of his principles (§174g). Essentially such detail consists of the establishment of human measures—is the science of humanics. And that science will develop just as has physical science, having for its goal the continually more accurate expression of human measures in terms of money.

k. So men *play* or *worship* for inner fame, or self-respect

unit that is fairly steady and so serves rather definitely to symbolize human relationship or credit or *promises* to *pay*. Promises are credit, are dealt with by banking, and perceptibly include the estimating or measuring of thousands of human characteristics and of material possessions; banking is the relating factor, the coordinator, the Holy Ghost of finances or "business." Every transaction in credit obviously is a perceptibly unique quantitative problem. And the *pay* which is promised is finally money: in sum it is a standard universe or One, and is made up of unit Many parts or dollars. The total problem of "money" is to *agree* that a certain mass of (say) gold is a dollar—that gold *itself* is the dollar, and not the chance of getting it,—and then to stick to that agreement *definitely*. If we like we can have that mass or weight of gold vary by certain stated rules; that is a mere matter of convenience, and in my opinion is inconvenient; but the essential point is that we be definite about sticking to that agreement; which means in practice simply that *all* money be the actual bonafide gold, or a secondary symbol of such actual, possessed, available gold *and* that such symbol be so definitely and easily distinguishable from *promises* to pay *if* the gold happens to be available that a child can tell which is money and which is some species of mortgage or promise.

vii. And the solution of that problem of money itself is obviously child's play. The difficulty is fundamentally to get men to stop trying to fool themselves as to what they own and what they hope to own, and the only cure for that is education, or in numerous cases, death. A practical partial cure for it is to take the government out of the banking business. Our government has so thoroughly demonstrated its inefficiency in business in the past few years that there seems to be no need to state the evidence and reasons why the government should not engage in banking, which when properly conducted is the most difficult of all businesses and the most indispensable—the flywheel of all business. The government would then simply make fair rules for the bankers (a job more than enough for the wisest government), fix the weight of a gold dollar, issue secondary symbols of the gold it stores, see to it that nobody else issues anything that can be easily mistaken for such actual money, and in particular keep itself from doing so. I am aware that there will be the customary protest that that will make the currency inflexible, restrict it, etc. Naturally: it eliminates the fictitious money which never nourished us anyway, and truistically never can, and which we with painful offensiveness vomited up at frequent intervals. And that clears the way for bankers to do a real business with credit—issuing any sort of credit instrument that works well, so long as it does not deceive its holder as to its nature. If bankers or anybody else try to do business on make-believe, deception, lies, they truistically will fail. If the bankers and other people haven't the slight intelligence to see that we can't correctly estimate the value of anything with a fictitious unit which isn't a unit, with a dollar which is largely and in an unknown degree water, and next (which is where the rub comes) haven't the strength or moral courage to drop such wildcat currency, then the simple answer is that the nation *has* gone to the devil. —— Our method of fooling ourselves by issuing fictitious money as to what are hopes and what are achievements (real money) is the economic or business form of a continual Pollyanna "glad game" (§149f). Naturally human nature, especially that of the "tired business man," can't stand the strain of such continual ecstacy or departure from a sane balance, and we necessarily have revulsions from such abnormally optimistic, price-raising, speculating tensions—those sick-spells, forced upon us as resting periods by the absolutely just universe, being panics, depressions.

or self-approval; and *work* for money or for outer fame. But in both play and work the primary attention is on the game or activity; and on the rest side of the cycle the attention goes to the payment, which is the *re*action. So when we name what men play or work *for*, we have to name the reaction or payment, and do not state the character of their activity. The equation is:- *What the play or work is for...* × *Work or play...*=*Meaning*. Usually we incline towards confusing the parts of that equation in our minds. But obviously, no intelligent man works for fame or money *as an end*. The "end," or the One *Meaning*, *includes* the pleasure of his own activity or living; in a continuing society that is necessarily supplemented and completed by the perceptible approval of others whose opinions he values, expressed in fame or money (preferably in both, as checking each other). The fame and money, combined with the work and play, give the man some degree of rebirth, or a *Meaning*. That *Meaning* is conventionally named *power*—which thus really means energy, or universe, or God. So we again finish the circle, getting the truism that the "use" of living is to live.

l. So truistically men work or play for the sense or feeling of power it gives. The man who wants to work or play so that he gets his pay from somebody far off is correct in thinking that getting it increases his life (the *L* or extensive factor is increased); but he often makes the practical mistake of neglecting his own affairs or family to care for the "heathen" or make love to another man's wife, so that he largely loses the intensive factor *and* by doing so destroys much of his ability to enjoy the wider *L*. —— And the "ambitious" man who strives to pile up more fame or money as a sort of end in itself is merely more or less insane (power-mad); probably it is kinder to him to agree that his brain is defective in a pathological degree. The sane man who strives for power, the properly or morally ambitious man, is clearly conscious that the equation has *two* factors (*Fame or money...* × *Work...*=*Power*), and that the intensive factor—the one he primarily sees, and chiefly tries to get directly—is the *work*. —— Obviously, this working and playing to get power is identically the same as striving for activity or life or happiness, or getting religious experiences or rebirths, or the same as being a genius. And clearly, the same principles apply; power is *Meaning*, or the "springs of action," or God, or energy, or the universe, named from the point of view of value. —— So a man works for power because it essentially is religion. But as we saw (§§153, 162), a rebirth can be too violent, and easily drive a man mad (cf. §173e). And it is even more easy to get too much power, which is one sort of rebirth (one which is 'reinforced' by perceptible "objective" things), and go mad—become unbalanced or overloaded to perhaps the degree of pathological insanity. We consider the details of power-madness in various places. We may note here that the selfish grabber of power, either in money or fame, usually gets it if he grabs a little vigorously—and then he pays for it by its destroying him in a just degree. He always pays.

m. As the money or fame acquired should truistically be in fair balance with the work delivered (because the two are a cycle, *Money...* × *Work...*; §167k, 114c), it then is an equivalent truism that if a man is given more fame or money than he can use, both he and the people who give it are wrong and immoral. (As verbal love or fame is so carelessly given, for brevity and precision let us confine this discussion chiefly to money.) Clearly, if the man is given so much money that he can not use it all before he dies to pay for things he can actually perceive for himself (including of course fair money payments for all the services he receives, especially for the reactions of his immediate family), he then can not take the money with him, and truistically has been shown by such reaction of the universe to have been overpaid. Carnegie discovered that the man who dies rich dies disgraced; clearly that is a first class discovery, that makes him a peer of all the great prophets. He also made other first class discoveries (see his "Problems of To-Day," which is surprisingly valid, the only logical error of much importance being his idealization of woman substantially to infinity). And he handled men in a first class manner, which is a good deal harder to do than to make first class discoveries and shows him to have been a great democrat in character. So I judge that Carnegie fully earned all the money he got—which is something I think can not be justly said of many manual laborers. There are of course numbers of rich men who are just as bad grabbers as are loafing workmen and extreme socialists; the first step in the process of dealing with them is to learn to distinguish one when he appears. But there are many rich men who have thoroughly earned their money, and are peers of Carnegie:- Rockefeller, Eastman, Ford, Hoover, Wanamaker, Edison, Schwab—to name only a few well known ones.

n. The principle obviously is that a man gives work or energy to others on his catabolic swings from the balance; and then as a just reward (in physics terms, a necessarily equal reaction) should receive as much money as he can use to get him in return an equal amount of energy on the anabolic sides of the cycles. If he labors prodigiously for others as those rich men named above have done, then by all laws and morals he must consume equally prodigiously to keep balanced. —— There can be no exact science; so it is not possible that the man die with exactly no money left. But if he is highly intelligent or moral, after paying his family what they have actually earned, he obviously would have left (or owe) but a trifling fraction of what he earned. So it is an absolutely rigorous principle that if a man has wealth left when he dies, it belongs to the people and should be returned to them. Or, no man can morally bequeath wealth nor can others morally permit him to. As a fact, our common law for centuries has held that principle and it is vaguely enforced as inheritance taxes. A man *is* disgraced if he dies wealthy, provided he hold that in principle he ought to die wealthy. But of course his family and others may have actually earned some of the money that is merely nominally his and should be awarded that part (as a right, and not as a gift or "bequest," in whatever amount or percentage the majority thinks just). Clearly, to give a child wealth so that he need not "work," or may have "advantages," or "opportunities" (or whatever else the euphemism may be), is (1) to cheat the people out of money that they overpaid, and (2) to cheat the child out of a chance to live just that amount of life (for in order to got rid of that wealth he has to "rest" and die inwardly in an amount corresponding to that wealth—he truistically having to pay for it, and that being the only way left him to earn it). The son who inherits his father's wealth is as pitiful an object as a son loaded with his father's surplus fat, assuming the foolish father could devise means of fastening that fat on him (the simile is grossly vulgar: so is the inheritance of wealth). —— There being no exact science, obviously there will never be any general agreement as to how much the family of a deceased rich man has earned and how much 'infancy' care his children should receive, and how much ought to go back to the state. If the simple principle is accepted, I think it safer to let each rich man decide his own case, subject to revision if much disagreed with.

o. It is obviously just as immoral for a man to *want* to die in debt, and without paying his family (especially his wife), as it is for him to want to die wealthy. Most men

recognize that side of the truth. Sometimes society decides that it has not paid the man enough, and morally discharges the debt by pensioning the man or his family. Truistically, the man should not have permitted himself to be thus underpaid, and society should not make a mistake that requires such correction. But it is obvious that these money measures are in such a primitive state of uncertainty and vagueness that it is scarcely just to criticize anyone for making a mistake of a fairly small percentage of his total earnings in either direction. —— Problems of fame are even more uncertain than those of monoy. The outstanding *qualitative* one is of course obviously solved rigorously:- that it is immoral for a man to desire to leave a *hereditary* title to descendants; his descendants are immoral to accept it, as are the public who approve. Such titles are an attempted dualism.

p. There are some people who fancy the world owes them a living—owes them money and fame enough to permit them to survive, regardless of how they work. Truistically, such people in effect assert that they have a right to rest all or most of the time, and do no work or little. That is parasitism, being an assertion of getting something for nothing—an absolutely wrong, immoral, impossible principle (§§88, 114c, etc.). Frequently the delusion that the world owes him a living takes the form:- that one man deserves as much fame and money as another—that men are quantitatively equal; that is obviously wrong and impossible for the same reasons (it is considered in detail, as a form of socialism, in §175). My observation of the world have been that those who hold such delusions are the "submerged tenth" (or are becoming members)—people who are so nearly worthless and unreliable and generally obnoxious that they richly deserve to starve to death (which they usually do do, in a slow way). Further, the submerged tenth are so callous, unfeeling, and generally defective in nervous action that in my best judgment it hurts them much less to starve than it does me to have to notice such unlovely beings. It is quite true in a wide sense that nature, including us and them, has made those nasty beings what they are; it is also equally true that nature, with finally beautiful consistency and justice and fitness, is now eliminating them without much pain to them by starving them. —— The fairly correct judgment or measure of the deserts of those dregs of humanity is:- *I* see the process of their elimination, and in *my* nervous system there is pain from their squalor; they themselves are considerably more comfortable in their condition than I am in seeing it (else truistically they would struggle out of it). (They all the time have the very mild pain of degenerating, and I have it only when I have to notice them; hence, although my pain is more intense, they have pain and its causes longer (*T*), which kills them more effectively than it does me.) So because I can not practicably help being always in indirect contact with those slum-dwellers and lazy casual laborers and shirking dregs (they breed crime, and disease, and dirt in general, which can not be even perceptibly isolated), I desire to give them enough money, love, etc., to make their conditions fairly tolerable *to me*, in return for my trouble. *But*, obviously that is a *selfish* activity on my part. Those dregs are so obnoxious that I selfishly slow up the rate at which nature is eliminating them. The good which I get out of that selfish action is that I keep my perceptions keen and uncalloused by avoiding subjecting them to the sight of too intense misery (misery from *my* point of view): those dregs have to pay for my improvement by dying more slowly. They fancy of course that by their whinings that the world owes them a living, and other misapplied One conclusions as to the equality of man, they get desirable pay. —— In the same way there are some men on earth who richly deserve hanging. We are selfish when we do not hang them; for the real objection to capital punishment is that it badly destroys the nervous systems of those who have to do the killing or see it; so *we*, for *our* benefit, avoid killing when we can. —— I am aware that this paragraph sounds a little unconventional at first. But I think the reader can readily see that it is a point of view that conduces to the widest grasp of facts as they are. Of course, it is correct to take the other point of view that theoretically we can *ultimately* lift any given hobo or all present hoboes (in several generations, if required) to a quantitative level with ourselves. Certainly we can; we can also make a Venus of Milo of mud, and then turn it into marble. But by using marble already available, or working with more promising human material, we can do much more. While we were uplifting the given hoboes a new crop would grow from our neglected children. We simply have to do what we can to keep those dregs from damaging us: to remove from them all hope of "patronage" will itself in considerable degree stop such damage (§176g). —— Given a steady climate the standard of living steadily rises. The submerged tenth (as a result of the efforts of geniuses who entertained no parasitic delusions) now live physically as comfortably in this country as the wisest people did three or four centuries ago (and those dregs do not profit by such opportunities). But truistically there must always be, as long as there are men, a zone or difference surface of mankind, composed of men merging into organic structures of other orders (dying off): it is merely the infinite regress. Such a difference surface, by absolute principles, is at (or is) each "end" of society:- being the aristocratic "upper ten" at one end, and the aristocratic "submerged tenth" at the other end. So regardless of how much we raise the standard of living, in the very nature of things those two degenerate or dying zones or ends or difference surfaces of society remain—that being a truism. It is absolutely impossible to remove such zones. If we "rescue" one hobo, or one financial pirate (i. e., educate him as well as know how:- make his brain of 'mud' grow), and get him thus into normal happiness, we have to neglect rather painfully and unjustly to them perhaps a dozen fairly normal persons so that *they* start slumping into one of those dying zones.

q. This section gives only the outlines of the theory of values. The last paragraph would require a volume to notice merely the details we use daily. E. g., it implies that the principle truistically is that "punishment" should be automatic or natural (the offender's attention being called merely to that automatic reaction), and never be the formally capricious fiat which punishment is dualistically supposed to be by aristocrats (§173b). And that shows that the top scum and the bottom dregs—the two aristocratic ends—are not essentially evils: they are the natural results or punishment of certain sorts of living, and are useful in teaching us how not to do it. We have to *pay* something to learn, and we pay by being annoyed by their presence.

§169. a. We have seen that morality consists of consciously maintaining a balance from a Many aspect, that resulting in more or less vivid religious experience or *Life* or gain of power in a One aspect. But obviously, that point of view of ethics is mostly a personal or subjective one—a statement of how we view our own happiness, or get it. We now see a short equivalent statement of how we view such morality in others. Such 'objective ethics' strictly is *sociology*.

b. We first judge the morality of others, and then compare that morality with our own. That truistically amounts to putting the appropriate conventional names into our ethics equation *Unselfishness...* $\times$ *Selfishness...* $=$ *Happiness*.

c. As there can be no exact science, it follows that no

one can be perfectly temperate no matter how hard he tries to keep balanced. So truistically we should *tolerate* in various degrees a quantitative failure of others in temperance. As a One proposition or principle, as *all* action in the universe is finally balanced (§114c), we should, as a truism, tolerate any quantitative departure from temperance in others, as it is only local (§25c). But such departures have *for us* zones of pleasure, pain, death, etc., just as our own acts have (Fig. 163b). So we in Many practice must (if we care to preserve ourselves) limit our toleration in quantity by the principles of §163. But so long as the other person does not consciously intend to hurt us by his departures (except perhaps for what he thinks is for our benefit), we must in principle tolerate his acts *if* (1) we have any available means, in case we disagree with his judgment, of separating ourselves from him by enough space (making L greater), or-and (2) can make T brief enough for us to endure:- for obviously, the extensity and intensity *for us* of his acts can be lowered by such withdrawal on our part until they are easily bearable by us. So the general Many principle of toleration is to increase L and decrease T with respect to the acts of others who try to be temperate. If the other person is practically unable to control his acts even though intending to do so, and we ourselves are practicably unable to move away from him, then we effect the needed increased L and decreased T by putting him in jail or an insane asylum, in accordance with the guesses at measures of the majority (§171k). In the case of married partners such a needed change obviously may, and in principle must, be provided by divorce. And so on. Clearly there is a vast science of toleration (of the best ways of getting a balance, *Others' actions...(←Toleration→)Our actions...=Happiness of society*) omitted at this point.

d. We shall next consider toleration from the One point of view. If any man consciously asserts that he proposes to make either factor of any *That...×This...* formula become either zero or infinity, then he *verbally* is absolutely wrong in principle—he asserts that the One is something other than what it is, denies God; and his assertion is *absolutely intolerable*. In short, he in effect *asserts* that we must stand from him some infinite action, and he is *verbally* infinitely intolerable. As an actual fact, he cannot perform any such infinite action: his logic is silly. But of course his conduct is then formally *unpredictable*, and in principle intolerable. Formally or in principle or from a religious or One point of view, any dualism is intolerable. *There can be no compromise with formal error*. That is absolute. And when the dualist insists on acting so far as he can according to such lawless assertions, we are absolutely justified in killing him, and are morally obligated to do so if it is not practicable or convenient to restrain him otherwise—that being a truism too obvious to need explication. But of course it is usually easy to restrain such foolish or insane persons, as their weak brains make them generally weak: for our own well-being we ought selfishly to avoid killing except as a last resort, as it is too crude and violent—as I happen to know from direct observation of numerous killers and killings, and as the reader can readily verify from history if he suspects the obvious theory and hasn't made the observations.

e. It therefore follows that socially we have a balance of rights and duties, of pay and work, of privileges and obligations, thus:- *Rights...×Duties...=Privileges...×Obligations...=Ethical or natural law* (*or Legal law, if those are legal rights and duties*)*=Liberty, Equality, Fraternity, Freedom, Law of humanity, etc.* That equation indicates the general principles of those much-discussed terms; those principles are merely various points of view of the general *That...×This...* formula, and I shall give only a few further suggestions about them, putting those suggestions in terms of *freedom of speech*, —the principles clearly applying to those other terms.

f. In a One sense we obviously in our ultimate capacity as God can say anything we like. So truistically we have One freedom of speech. —— In a logical Many sense, compared with the One sense, there can be no freedom of speech—it being determined absolutely, by the same principles that the Many will is (§157). —— We practically use the equation *Freedom of speech...×Duties or obligations of speech...=Law, or Contracts.* There, of course, "free speech" by technical logic is not free; but practically, obviously by that equation (or natural law) we as individuals have complete freedom of speech *if* we want to tell the truth and also want to tell such truth as is quantitatively tolerable to the majority as well as to ourselves. (E. g., it would be painful to our skin-bounded selves to talk all the time; so we do not want to. But obviously, if we stop to sleep we personally have not absolute freedom of speech—although we do not regard such actual restriction as any restriction on our *Freedom of speech...* .) If we do not want to be truthful and temperate in speech in that way (or haven't the ability to be so), then inevitably the other men (if *they* are to survive, be moral, etc.) must constrain our speech in some degree—for they, like ourselves, have a One right to a just or balanced sum of speech into *Social contracts or unification*. Speech from us that is tolerable to others and fairly accurate under given conditions of L and T, may become painful to others or-and somewhat untrue with different L and T. That principle is usually tacitly accepted—definitely and glaringly so in time of war, when men have neither the energy nor the time to bother with much intemperateness of speech in an obvious minority. The principle is simply one way of saying mass varies with velocity. —— So we, from *our* point of view, are as a general rule (are, *except when we use initiative*) moral when we conform our speech and want to conform it to the limits of toleration of our neighbors. If it pains them to hear certain assertions, over or below certain amounts of speech, or certain speech in certain places or times, then (1) courtesy or minor kindness, (2) good morals, and last (3) the statute law, make us want to conform, or constrain us to conform, to *their* measure of nerve toleration (Fig. 163b). *But*, there is the other side of that Many balance. Our neighbor may be badly wrong in his estimation of the truth, and so narrowly tolerant of any speech but his own as to indicate brain defects (cf. the lese-majeste laws of the late kaiser). All aristocrats—Bourbons, reactionaries, autocrats, incompetents, parasites, hysterics—consistently hate criticism to such an abnormal degree as to try to restrict the speech of others, while trying to retain for themselves the right to speak recklessly. So at times it is desirable that the moral man *take the initiative*, and with carefulness and temperateness, exceed somewhat the traditional limits set up by those defectives, and pain them by his speech, if that speech is designed to be useful to the majority of people.

g. There is another aspect of the problem of measuring the freedom of speech. We may consider that aspect in readily grasped concrete terms, although the principles will be obviously general:- If the authorities of a college hire a teacher, they evidently have the right as a rule (unless there is explicit statute law which asserts that it is not to the best public interests—and there may be such law in places, and it is an interesting quantitative question whether the Constitutional provision for freedom of speech is such a law) to require of the teacher a constraint in his speech that is in their opinion in keeping with his official position, and also in fair agreement with their own views of the truth. They pay the teacher for his speech, and they clearly have a right,

if they demand it (and if the majority have not decided by law that it is against public interest; §171k). (The teacher does not have to accept such a contract, and of course should not if he does not agree with the authorities; etc.) —— *But*, if they demand that constraint in speech they should put it explicitly in the contract that they do; for the teacher obviously has an equal right to take it for granted otherwise that he is constrained only by the usual laws about speech, and there is a presumption that the authorities are the high-grade tolerant men described in the next paragraph, and are not too cowardly to put any such requirement in the contract or so stupid as to forget to. —— Also, although if they demand it they have an unquestioned right to require such restricted speech (subject always to what the majority say is to the public interest: it is possible that the public will soon hold that the Constitutional requirement of "free" speech applies definitely to a quasi-public institution like a college), they truistically have to pay these prices for the exercise of that right:- (1) No intelligent person can believe that such a restricted teacher is always stating what he believes to be the complete truth (as a truism he has no right to, and his credibility can not extend beyond his restrictions). (2) The teacher to be comfortable may not inquire or observe beyond the limits of his restrictions. If he does go beyond the authorities' limits he is in danger of finding that he is not speaking the full quantitative truth. So he is often narrowed to those limits—not necessarily so, of course; unusual men have energy enough to take a chance on being uncomfortable and resigning or being discharged. (3) The authorities formally set a limit on their own growth or lives, and forbid any useful criticism (perhaps they may "welcome" private or secret criticism—which is easily pigeonholed), and similarly in effect forbid any progress in their school. (4) They in some circumstances (not in all: it is a quantitative matter) in clear effect assert to the world that they are not strong enough to bear the possible truth about things; and also that (under some circumstances) they haven't enough sense to select a teacher who will talk with judgment, discretion, and courtesy—or the courage and will power promptly to admit the occasional mistake the wisest authorities will make, and discharge the temperamentally unfit teacher. —— Clearly they have to pay those various prices, subject to the various actual circumstances, whether they wish to or not: there is no way to get something for nothing.

b. Also, there is a price automatically extracted of those who insist on too much freedom of speech—of the teacher who fails in fitness and courtesy. If his words are of so little weight, exert so little force, that he can expect to speak them quite freely, with no appreciable sense of responsibility, then he has advertised them as being in his own view practically worthless. —— Truistically the highly moral person (the genius; §159) conforms to the following rule, which defines what freedom of speech (and analogously, any other liberty, right, or privilege) means to him:- He has such a wide personal limit of toleration that he pleasurably receives all the words that others wish to say, on the basis that none of them can exert enough force to go beyond the limits of what unduly pains and unbalances him, but that all he has time to attend to, especially the adverse ones, can teach him something—even if no more than that the author of them is pathological. But with respect to others, he will carefully weigh his words (without overdoing it and becoming a precisian or other variety of prig who underrates his audience by fancying that they are unable to enjoy an occasional stiff jolt), so that they will serve to give pleasurable and healthful activity to normal people. In short, the moral genius allows others all the freedom of speech they want (he may point out that careless freedom will harm themselves); but he willingly and enduringly severely restricts his own.[169h] —— And the aristocrat is opposite:- He allows himself intemperate, exaggerated, dualistic speech—swearing (§43k). But as we saw, he wants others to restrict their speech, and above all to refrain from any criticism or verbal opposition. The aristocrat is "touchy" and personally secretive, like an old-style diplomat, and inordinately sensitive to criticism of himself—which although superficially contradictory to the fact that his brain is narrowed, is seen to be consistent when it is considered that what brain he has is strongly exercised on his own ego. The aristocrat is often unable to recognize his neighbor's existence until his neighbor makes a slight criticism that would not trouble the normal person; but then the aristocrat observes the criticism with painful intensity. That queer but consistent susceptibility of the aristocrat or parasite accounts for the curious thing known as "Society," which with superficial paradoxicalness runs on the they-say's of servant girls, waiters, and rumor. —— But at the same time it is quite possible that (say) the authorities of the college could properly consider that they had not time or energy to attend to any sort of disagreeing views. A censorship is desirable in certain circumstances. But in most cases a censorship is probably immoral, and indicates that those who establish it and those who docilely and weakly submit to it are aristocrats—at least that is what the Constitution implies is the view of the majority in this country (§173).

§170. a. We saw under biology that the race has automatically in its progress and as a marked part of the progress divided into reacting sexes, *Female...*×*Male...*, which are quantitatively perceptibly different. We saw under ethics (§166) that the conscious reaction of the sexes then truistically gives the maximum of life in normal cases, and hence the maximum of morality or happiness. (There is no absoluteness about that quantitative proposition, which is a statement applicable to present conditions; under conceivable conditions perceptible differences in human sex could disappear.) And as a further ethical truism, we saw (§167k) that maximum morality or democracy requires that in all reactions we consciously recognize the quantitative differences of the two parties or factors. So as an obviously circular or rigorous truism, we need a general theory of quantitative differences of human beings as a general basis of being moral—as

[169h] E. g., this book would have been easy play to write if I could have written as many words as I thought of—letting loose without regard to a complete fair balance and emphasis. But often it required painful nerve tension or concentration to condense and save the reader's attention while at the same time making no omission of important points, and getting what seemed to be a fair balance of emphasis. The degree of success with which I accomplished that general quantitative balance while at the same time avoiding inflicting any of that tension on the reader is the degree in which the book is "literature." In my judgment that degree is low. But the point of the example is that the principles of freedom of speech give the standards for determining what is "literature." —— Incidentally, the only way to conceal that tension from the reader—to make the book seem easy, simple, natural, and true as a matter of course—is not to have it. And the only practical way not to have it is to keep thinking hard just what you do mean—if anything—and rewriting it; after enough of such work you are really thinking clearly, and naturally can say it easily, with no tension. The difficulty with this book (or with any similar scientific book) which stops its being literature, is that as fast as I work out something clearly then I introduce the next step, which isn't clear and shows tension and lack of "finish." There are numbers of sentences in this, the umpty-somethingth, version which have no appreciable meaning; so if you strike a doubtful one it is not safe to judge that I meant something or that I didn't. A thought for literary experts:- nature is never neatly finished and dead like Henry James, or largely full of crude raw material like Whitman, imagists, futurists, impressionists; nature 'tries' to be finished enough to still keep going; so maybe this book is a species of literature.

was also shown in §167l. We have implicitly seen that such a theory is the application to humanics of the law mass varies with velocity, or is an application of harmonic periodicity; or more definitely, the increased use of money as a symbol of human measures is the application of such a theory (named *economics*); and finally, in practice such a theory of quantitative differences in human beings is given by jurisprudence (XIX). Obviously, those various aspects of the theory of human quantities imply its complexity—the numerousness of its perceptible details. But it is imperative if we are to *succeed in life* that we not only have some clear knowledge of that theory, but that we apply it.

b. So throughout this book I have been trying to show clearly the general ways of estimating human characters. To do that I have used three rough classes:- (1) The first class comprises those who successfully try to be temperate and balanced—moving in cycles of activity and rest so that the activity and rest perceptibly balance. (2) Then there is the fringe or zone of dualists or aristocrats on each 'side' of the first class, made up of those who go too far in both rest and activity, acquiring a steady accumulation of either too much rest (parasitism, loafers), or, at the other end, too much activity (egotism, power-madness, hysteria, etc.)—and sometimes both, in succession, like manic-depressive insanity ("Ency. Brit.," xiv, 603). This class is not normal, but is not usually considered to be pathologically abnormal; so its members are in practice considered to *want* to be unbalanced and hence to be responsible for their unbalance—although in a broader view nature is merely killing them off, and ultimately the universe is concerned and responsible. (3) And last there are the definitely pathological persons on each end of society, who are insane and considered irresponsible. —— Those aristocrats in class (2) and the pathological varieties of them in (3) are the same sort of people Christ called scribes and Pharisees (Matt., 5, 20; 12, 38; 16; 23; Luke, 7, 30, etc.; 20, 46; 11; Mark, 3; 7; 8; 12). I have merely been more definite about them, used their modern names, and shown the biology of their defectiveness. I have not "condemned" them, but I have shown that the universe is simply destroying them. And I have been more accurate in my descriptions than is the Bible. We saw that truistically there must be those abnormal classes at the two "ends" of our race (§168p), just as there are painful zones on each side of normal activity (§163). In a wide sense it is beautiful that those abnormal classes exist (§25c): for as we saw, they are needed to show us how not to do things, furnishing evidence of what would happen to us if we became intemperate. I know quite a lot about those abnormal classes from direct experience in being intemperate in numbers of ways myself.

c. But the statement of those broad measures or classifications of people may be profitably extended here by a brief practical application of the theory of human measurements or character judgment to normal people. Our perceptions have to be keener in judging such balanced people, for truistically there is less variation in L and T to be observed in them. So we may note the general differences between woman and man, as a general example of normal human measurement.

d. The basis of all measurement is L and T (Part One). So we observe man and woman with the purpose of finding in what fundamental way their activities have a perceptible difference in L and T; and when we note a definite variation that holds for normal persons we have the total theoretical solution of their quantitative differences. Obviously, that same principle applies to the finding of the differences in all other human classes: the principle is merely the truism that a property or characteristic *is* an L *and* T difference. —— Or, we can take this view of what we are about to do:- The foregoing ethics has in general been static or "abstract," or "theoretical" in the conventional sense of not being directly used as a whole. We are now going to summarize concretely or get some dynamic ethics (in popular estimation, I am definitely "rushing in"—dynamically—where angels fear to tread). —— The obvious L and T variation between man and woman that always normally occurs (also, in principle the variation is a truism of the theory of sex, §146), is that the sexual cycle of woman is longer or slower in T than that of man (or physiologically definitely involves more biologic L). The total normal cycle of woman obviously includes copulation, pregnancy, and birth and suckling of the infant —a matter of months;—whereas the cycle of man is, so far as is similarly perceptible, surely not more than a few days, and is practically only a few minutes.[170d] So it is obviously truistic that *as a whole* the nervous system of woman normally works more slowly and hence less intensely than that of man. Therefore, woman's nervous system *as a whole* is more integrated or "strong," is more stable or extensive, or *extensively unified*, so that she is of a more child-like or "undifferentiated" type than man, and does not react so violently with the environment as man, but can endure more of a long-continued reaction with the environment than man. Clearly all those general traits of women are merely truisms of our original observation of her slower sex cycle. And those differences between woman and man are I think usually agreed by most observers to exist. E. g., the final and most remote truism we just got is that woman can endure a longer reaction

[170d] That of course implies that copulation for a woman is not of itself what might be called a practically satisfying act—implies that she has no orgasm in the sense that man has. I know of no direct proof that such is a fact, although it is obviously theoretically a truism; appropriate measures of physiologic processes, such as blood pressure, would probably give such evidence. But there is ample indirect evidence that copulation perceptibly alone, does not satisfy the normal woman; some such evidence is given, e. g., by various nervous abnormalities of prostitutes—or by the very fact that prostitutes are female rather than male. The proposition is clearly quantitative, and what is quantitatively true of it in the present age by no means was fact in the past, or need be in the future: e. g., in many fishes the sexes would theoretically have a practically equal (and 'finishing') orgasm; and man was once a fish, and theoretically can again be one. It seems probable that just now man and woman are tending to become less dissimilar in immediate results of copulation (more "human," or alike, in the terms of popular man-woman discussions); but that is a rash guess, which even if correct now might not continue to be true in slightly changed conditions. —— I mention those vague suggestions, for which there is slight direct experimental guidance, to show how much variation is possible. E. g., it is probable that for twenty or thirty centuries women have been developing more and more a definite orgasm; some trends of history seem to show such a change—a comparatively rapid one to be thus perceptible. And if that is true, then the most important quantitative change and hence cause in history—the chief "key" to history —for that period would be that relative change in man and woman. As a fact, some historians think that the most important key for that period is the rise and decay of religious systems; it is shown (par. h) that woman is chiefly responsible for man's perception of religion (the theory of the morality of marriage, §166, implies it); so truistically *religious changes are themselves due to relative changes in man and woman*. Thus sex biology may serve to show a clearer history. —— Truistically, *any That...×This...* formula may validly serve as a base of history, or quantitative description of the past of this earth (which usually includes mankind as the chief object of interest). The "best" history is the one which uses the most vividly familiar and *perceptible* terms ("facts") for the two factors (provided they are not *too* vivid). It is generally agreed now that history should be more vivid and familiar or "real" than it has been made—especially that *Kings...*, *Generals...*, *Priests...*, and such terms are rather frothy (are merely the scum that implies the deep, important, familiar flows of history), and hence give history that is not especially relevant to the actual understandable factors, such scum being only superficially vivid. Also, history based on kaisers and such scum truistically is pathology; so necessarily it is as unpleasant as listening to a poor hysteric detail her symptoms—and analogously, mostly isn't so.

with the environment: and that is usually in quite perceptible agreement with comparative death statistics, and with the generally accepted fact that women are more patient.

e. Those immediate general truisms are obviously easy to get. They refer to the whole nervous systems of woman and man. But when we estimate a person's character we divide it into parts—"analyze" it. So we must now make a step often confused in people's minds. We change the point of view from the total or the large standard universe of *Environment...×Woman...*, or *Environment...×Man...*, or *Woman...×Man...*, to the smaller standard universe of *Other parts of woman (or man)...×Given parts of woman (or man)...*. As soon as we do that we note that we may use the ordinary psychological equation for woman (or man), *Emotions...×Intellect...=Nervous system.* We have observed that woman's nervous system is comparatively stable as a whole. We have seen that the larger part of the nervous system is concerned in producing emotions, and that only a small part (perhaps a part of the cortex) is concerned in producing conscious intellect or perceptions. Now, because it is a truism (the total argument or thesis of this book) that any *That...×This...* does ultimately exactly balance, then *Emotions...×Intellect...* must theoretically balance in a given person, regardless of which of the factors is most easily perceptible. So it follows that as woman's nervous system as a whole is slow, then the larger part, her emotions, must be slow and steady and sure and stable, etc.; and then that her intellect, in order to balance that in the long run, must be fast—or is intense, weak in a broad sense, jumps at conclusions, sees details excellently but begins to be unable to see details when they extend widely.

f. In precisely the same way, man's emotions are fast, intense, unreliable or undeveloped over a long time (compared, of course, with the average woman's), not so enduring as woman's, not very perceptibly unified or religious, fickle, violent, etc. And his intellect comparatively is slow, strong, steady, controlled, extensive, "thoughtful," "reasonable," unified, "cold," "hard," persistent or reliable, or "philosophical" or inventive (i. e., *abstractly* religious).

g. Clearly, man and woman are in general the 'reverse' or complement of each other. As soon as we consciously follow the theory of quantities by using specific *That...×This...* formulas with definite observation of just what sort of universe we are considering, it is easy to keep consistent even in such a puzzling problem as that of the nature of man and woman (and below we proceed with more details). In fact, it is almost too easy, for I readily get *verbal* contrasts between the two which sound as if man and woman were as different as night and day; but actually the two are so much alike, just as all human beings are closely alike, that it is often impossible to perceive many of these quantitative differences in a given couple. So the reader is requested not to take these clear verbal differences too emphatically quantitatively, and to note carefully that all the practical conclusions I draw are obviously based on my clear recognition that the differences in man and woman are *quantitatively* slight *usually*.

h. It is clear that woman, by slow, steady, reliable unification of emotions (in practice, by the application of them to the holding together of the family and the property of man), has in actual effect had more to do in *directly* establishing religion or civilization than man has had. (E. g., it was seen in §§155f, 166r that women today are foremost in expressing in a *directly* applicable way [par. j] fundamental advances in religious practice. Even Taylor's scientific management is not such a direct or humanly familiar and applicable "binding together" or religion as Mrs. Fisher's books.) Obviously, all the great religious or human generalizations or conclusions have been first formulated by the emotions of woman, and weakly or "intuitively" expressed by her comparatively poor intellect. —— And a superficially queer thing truistically resulted and still results from her poor intellectual expression of those generalizations. She was not able, because of the rapid and weak way she jumps at intellectual conclusions, to state or observe clearly consciously or intellectually the relationships between her various conclusions—she can not very well "come to the point." So she used an apparently dualistic logic—one omitting formal assertion of identifying relationships. (I. e., woman actually is formally logical in a classical sense: man does not naturally tend to use classical logic, but was so overwhelmed with the truth of woman's emotional conclusions that he formally copied woman's curious logic, which when considered explicitly and intellectually, and not emotionally or vaguely consciously [§17cd], is invalid.) So when woman had two general conclusions, she could not intellectually or consciously directly relate or identify them; hence she would intellectually ignore them, allowing her emotions to work on them, and soon they would automatically pop up into consciousness in a related or run-together condition—"*telescoped together*," so to speak, precisely as the classic logic "works" it. And neither she nor man knew how it happened—could *say* how it happened. So man with his steady intellect objected to that *unconscious* method of telescoping, and asserted sincerely that woman has no soul (in recent years it has been the milder assertion that woman is illogical—that being asserted in the face of the glaring fact that woman uses the classical logic man professes to use). It evidently does follow that she was not conscious of her mental processes: and as soul substantially means consciousness, it superficially did follow that she had no soul.

i. On the other hand, man, with his comparatively strong intellect, appropriated the general conclusions obtained by woman and strung them together (by the invalid classic logic —his very using of which is truistic proof that he didn't know how to get the conclusions he appropriated). He called that intellectual doing "reason," or religion, or science, or law-making, etc., after the fashion of the day, and claimed that it is a *superior* process, and that he therefore is "superior" to woman (formerly it was the essentially identical but verbally more emphatic assertion that woman has no soul). And woman in effect accepted man's criterion of general "superiority." Even yet all but a few rarely wise women (and truistically they can't *express* themselves clearly) accept that intellectual *criterion* of comparison as being correct and essential; e. g., the "advanced" woman, the extreme feminist, asserts her equality by specifically claiming to be intellectually the same as man, and proceeds to "prove" it by being "intellectual" (a few typical examples are given later). It has been seen to be truistic under present conditions that *in general* woman can not equal man intellectually (of course numerous individual women intellectually excel the majority of men); the historical fact (so glaring that even some of the "advanced" women have enough intellect to see it) is that there are no women *intellectual* geniuses who begin to be in the first class (some of those "advanced" women then whine that woman hasn't been given an opportunity to be a genius intellectually—which shows that they are intellectually incapable of grasping the simple generality, or seeing the often glaring fact, that genius *pays* for all the opportunity it ever takes). The rigorous principle obviously is that *intellectual superiority*, which by customary meaning of words is as a rule man's, is not a complete or essential criterion (woman is superior in emotions, which, as we shall see, is a variety of genius just as important and necessary and praiseworthy).

That superiority is merely man's ostentatious, showy, somewhat superficial, secondary male characteristic like the similar proud and arrogantly displayed tail of a rooster—and nobody claims that his tail makes the rooster superior to the hen, although *as a tail* the rooster's *tail* is superior to the hen's.

j. The question of "superiority" is the quantitative one of *direction*: as we saw in §99, there can be no "solution" of it, as it is merely an *agreement* as to methods of measurement. There are no absolute directions, and so men essentially are neither superior nor inferior to women, *but are merely quantitatively different.* The same principle obviously applies to all "races" of men, etc.: they are quantitatively different. Whether one is superior to another depends entirely on what is agreed as to arbitrary directions.[170j] In the case of woman and man, woman is superior in *Emotions...*, and man in *Intellect...* . Woman does the usually unnoticed foundation work, patiently stabilizes the important everyday things of life, half-consciously formulates all the fundamental religious relationships and turns them over to man, and gives a practical example of normal, useful rebirths. The man does the intellectual expressing of the further formal or logical union of that essential foundation work; it is a less extensive work, but emotionally intense, so that man notices it and makes a lot of talk about its and his "superiority." For an example take this book. I make some vivid, wide generalizations that are emotionally intense, and which require a "cool," enduring intellect (I notice that even some men who merely read it can't keep cool—moderately judicious); and by bygone ideas I would receive credit for far "superior" work than could be done by woman. Well; my generalizations *are* useful and did require intellectual steadiness; but they are substantially slight and indeed almost negligible in comparison with the vast foundations of facts and relationships established by people before me—the valid greater part of such substance being furnished by woman. I merely happen to do the spectacular showy part; but I personally am under no delusion that it is "superior" to be showy.

k. We saw that maximum morality requires cooperation and hence fairly accurate judgment of woman by man, and vice versa, and a primary knowledge that in cooperation the two reacting parties are *not* quantitatively equal. It follows:- (1) that cooperation, or maximum life under given conditions, required that at first man and woman be comparatively much different so as to force the perception of the differences of W and M (in $W... \times M...$ of §167b) upon each other—that the man be intensely male and the woman intensely female. (Before such sex differentiation occurred, the *environment* was similarly intensely different from the rather undifferentiated or rather non-sexed individuals—the same principle, giving amphimixis of individuals after several generations, etc.; cf. §146.) It follows next (2) that the perception of such wide and easily seen differences of M and W made M and W "*progress*" so that they could see, and react to, less differences: then they would be pained by such great differences. So it results as a truism of (2) that M and W normally, or in the course of that progress or "increasing" civilization (attainment of more delicate differentiation under fairly steady climate), tend to have less wide sex differences. To abbreviate that complete cyclic statement of "*progress*" given by (1) and (2):- all human phenomena with steady climate tend to approach a balance perceptibly (that is obviously identical with the theory of genius, §159). —— So, as an example, the genius, the properly developed person, will more and more tend to stop bragging about his or her extreme sexuality. Stallions and some male savages have to be kept away from the opposite sex; but in this reasonably civilized country even young men and women associate to their mutual benefit. —— And that tendency of the sexes to become less violently different—of each sex to become more of a balanced genius that includes in itself much of the other sex—is obviously accelerated by woman's make believe that man is superior because of his intellect (wise women are practically conscious that is a make-believe, and smile kindly at the man, or the woman like Mrs. Atherton, who takes intellect very seriously), and by her trying to imitate man's intellect to some extent and to do some of man's work, such as voting and otherwise wrestling with the *extensive* environment (where even the strutting male frequently comes out second best; note the infant manufacturers who wail to the government for suckle and protection from bad men in a cruel world). Clearly, that makes the woman understand man better, and enables here to cooperate with him, and is moral *provided* she does not overdo it and really fool herself with the exaggerated feminism of Mrs. Atherton, that obviously tends to dualism, with the practical conclusion that men and women conflict. But balanced feminists like Mrs. Fisher, Mrs. Warren, Mrs. Vorse (§166r), who both believe in being women first, with woman's superiorities, and *act* on that belief, and who then try some of man's intellectualities in order to understand man better, are truistically the best sort of women there can be (and incidentally, the intellectual work is good, as it has a sound, honest base).

l. The *man's* idea that his intellectuality makes him wholly superior is rather silly, and so mildly immoral. But the man has a sort of make believe that is the counterpart of woman's. Originally it was called *chivalry*, and consisted of his claiming to like to practice the womanly superiorities of emotional gentleness or patience, faithfulness or endurance, etc. That helped him become more feminine. And such pretense truistically would destroy somewhat his masculine strength of intellect.[170l] So male chivalry is recognized (in

[170j] I judge that the differences in various races (white, black, etc.) may best be summarized by saying that they are perceptibly different in *virtual* racial *ages.* They are different quantitatively, just as a boy is different from an old woman; and there is obviously no question of essential superiority. For precisely the same reasons that children born of a boy and a woman of forty-five are likely to be not of the best inherent quality, and are also likely to receive inferior nurture, intermarriage of differently aged races is in some degree objectionable—although some things resulting from refraining may be *more* so (§176h). However, the conditions of life of a race make the race *virtually* grow older *or* become younger, just as a galaxy fluctuates in virtual age (and as can a person in considerable degree, though not nearly so much). So *it is possible to make the races approach some fair equality of age.* It may become necessary to do it; for as we improve our tools it becomes more and more impracticable and immoral (a waste of life) to keep the races "pure" (§176). If the races are to be kept somewhat pure, then the earth's population must be kept less. The population in a better and wiser civilization than we have achieved will have to be *consciously* controlled, instead of being, as now, more painfully controlled by rain, potato bugs, power-mad statesmen's wars, etc. Those are questions largely for future men; they can best be solved by the people who are to use the solutions. We rather unnecessarily trouble ourselves when we undertake to solve such quantitative problems for the posterity that is more than twenty years ahead—and about one man in a million can make a sensible guess that far ahead; and I am not that one.

[170l] On the contrary, and as an indication of the consistency of this argument, it is obvious that pretence or make believe (§155) by woman does her less perceptible damage, as her intellect is already of a nature to pretend more or less automatically (which is shown by the fact that it is women who usually have hysteria, which is an undue exaggeration of this normal feminine characteristic). So we usually do not expect the mediocre woman to be very truthful, though such truthfulness (especially in keeping his contracts) is demanded of the mediocre man, and is beginning to be demanded even of the casual laborer and labor leader and diplomat and press agent. But the mediocre woman is required by the majority to be emotionally stable or reliable, which in practice is translated into the demand that she be sexually chaste, whereas that is not required of the mediocre

this country at least) as being an offensive pretence or else a meaningless ritual. But men of this country have generally substituted for that chivalry a real belief that women are more or less angelic (§166o). Such idealization of woman truistically tends to make men acquire somewhat the feminine superiorities, and works better than the ritualistic forms of the decaying chivalry.

m. From an intellectual or "spiritual" point of view we may get rid of the objectionable vagueness of such idealization, and its frequent untruthful exaggeration of the quantitative differences between man and woman (which encourages parasitism, and all the less evils that any considerable inaccuracy does), by explicitly recognizing their ability to experience normal emotional rebirths and thus give men religion. The normal woman *is* angelic, and an essential complement or "comfort" or partner (cf. par. p) to man, in that she does not have the vivid and shrill variety of rebirth (with all that implies) of the normal man or of the emotionally narrowed or "unsexed" female (usually one who is clearly a hysteric, such as St. Theresa). That normal-emotion, feminine sort of actual genius is not dazzling or "brilliant" from an intellectual point of view; yet it is fully as valuable in life as the male sort of genius. As a man I naturally take the point of view that it is harder to achieve that feminine genius than to make the shallow even though universally extensive generalities which a man can make. So like any normal man I have very little use for the glittering "intellectual" woman; but I have a profound interest in the talk of a woman who has developed considerable intellect on the honest base of her own superiorities. —— Women have trouble in grasping intellectually or consciously a universe that is much larger than their own family or circle of friends (men have the opposite characteristic; e. g., I have it badly enough to pass my own wife on the street without seeing her when I happen not to be thinking of people). So they tend to pick out a man who can generalize intellectually for their religious guide. So women tend to take Christ more seriously than men do.

n. Concretely, man can honestly and practically idealize women, without any danger of making parasites, by undertaking to some extent to feel with his wife the importance of family life, and especially the deep and wide sort of continuous rebirth which is experienced in caring for children. For the details of that, see the books of the sound women writers; I have the male incompetence to state them without making a mess of it. Women who use their superiorities readily make a fine standard universe out of their homes (or, of a small circle of associates, if they are unmarried), which is perceptible enough to them to be a very real religion. A man who does not want to attend to those multitudinous details of woman's life thereby implies that he wants to depart from the balance instead of approach it—and hence is immoral. Men will not have the patience to stand much of that domesticity; it will be work; but work is an essential part of happiness, and of course the man should not subtract energy from his intellectually-enduring work, whatever it is. —— That concrete idealization of woman by men will obviously also profoundly discourage the radical feminists and parasites who object to much domestic life—especially those who object to being personally responsible for the care of children. All female parasites are the lazy women who do not care to use their emotional patience; so practically they dodge *personal* care of children. They experiment more or less irresponsibly with children, and having acquired obligations, turn the real care of the child over to servants.

o. That explicit statement of cooperation between man and woman, with definite recognition of their quantitative differences, is equivalent to the theory, in economics, of specialization (or division) of labor, or to the *combined* laws of increasing returns and of diminishing returns. These quantitative differences of the sexes, from that economic point of view, give the great "natural" division of labor that produces the greatest results. —— We have seen that any machine must have at least two reacting parts before it will work, or logically even exist. If all persons *do the same things*, then truistically humanity as a whole would not be a machine, or a mutually reacting democracy: there would not be any "competition" or love or friction, but merely a zero interaction of men, and hence *no* economic product of such a 'society' (Parts One and Two). I. e., if we run what is usually called *competition* to infinity, the race itself merely logically disappears. (It practically would be like trying to run numerous series-wound dynamos in parallel—and the physicist can finish extending that simile to all aspects of this problem. The dynamos would be destroyed.) If we are all alike economically, meaning that we in general all try to do the same job (suppose everybody tried to catch fish—and nobody supplied water, or fishing gear, or needs for cooking), the product diminishes to zero—or the race perishes. When numbers of the same sort of bacteria live together, doing the same things, they interfere and their growth practically stops, etc. The same *law of diminishing returns* is a universal truism stating that the growth of any structure or organization slows up as we depart from the optimum balance of direct action and reaction (it is a partial statement of periodicity; see Index). —— On the other hand, if some persons react with others —in an *explicit* machine, or *That*...×*This*...,—then we begin to get an organism, or a perceptible or *increasing* product (a mere truism for *growth*; see Index). The product goes on increasing until there is a balance of "competition" (which does not imply "fighting," but a reaction) with organization —a balance of specialization with a coordination, or general growth, or integration of social or any other sort of structure. Beyond that balance the same diminishing return recurs. I. e., the principle is shown by the hyperbola representing *That*...×*This*... (Figs. 104b, 163b). Germany in rough effect tried to make a *total* specialized organization of the whole state (a military, or bureaucratic, or paternalistic one), and being a vigorous people, blew up into a war; Rome, having largely weak people, went towards the zero side and slumped more or less into nothingness. It was intemperate "efficiency," or too much organization or centralization; it was like trying to make the digestive tract [government] extend directly to every cell in the body, which scheme would, to succeed, have to destroy all the body but the digestive tract. When we try to have the government "pass a law" to regulate every little detail we are destroying the government and incidentally ourselves. Also, every little law adds to the tax bill. —— So obviously, we have the *general economic law* implied by the following formulas, which are in agreement with our whole argument:- *Various organizations or companies or "staffs"*...×*The specialized men in each*...; or, *Specialties*...×*Particular men in each*...; or, *Increasing returns*...×*Diminishing returns*...; or, *Capital*...×*Labor*...; or, *Supply*...×*Demand*.... There must be a *division of labor*, or a "machine," or temperance or balance in economics (§§114c, 149,

man. In short, a difference in "moral standards," meaning sex standards, is, for *mediocre* men and women, consistent with facts as they are, and is moral. If the mediocre woman were as truthful and hence intellectually as just as is the mediocre man, she would stop complaining so much about the unchasteness of the mediocre man. That man is more just, and hence makes little complaint of the untruthfulness of the mediocre woman. That truthfulness in man pays or compensates the mediocre woman for her chastity—balances it. Of course, both, in order to lead fuller lives—be more highly moral, —ought to eliminate their mediocre traits.

etc.); otherwise destruction results. —— I have tried in this one paragraph to give a general outline of the whole of economics. So it is extremely condensed. But as the principles are obviously identical with the principles of *That...* × *This...* I shall not add a chapter of repetition of them in terms of economics. The reader who wishes to see directly and vividly in some detail such economic principles is referred to the first fifty pages of Reeve's "Cost of Competition." On p. 45 of it Reeve gets a general economic equation equivalent to our *That...* × *This...* equation, although his *explicit* logic is wrong. The remainder of the book is, *as* economics, piffle, although it is a beautiful mystic statement of altruism carried substantially to infinity and contains some extraordinarily useful facts. He shows the difference in money price that exists between what the producer gets and what the consumer pays (it is a surprisingly large per cent—probably after making some needed deductions from Reeve's figures amounting now to 50 per cent); he calls that amount, which is got by the middleman, the cost of competition, and proposes that it be wiped out by turning buying and selling over to the government (which he tacitly takes as being practically perfect in all respects). As a matter of obvious fact (which shows the truistically correct solution of the middleman problem), that "cost of competition" is actually the cost of ignorance, and is borne in rather perceptibly just proportion by everybody:- the producer doesn't know just what it costs him to produce, how much, when, and what to produce, who wants it, when, where, and how much, and how to get it there, etc.; and the usual ignorance of the consumer is too abysmal to detail in the limits of this book—'he wants what he wants when he wants it,' he usually resents being asked to use his mind appreciably in the matter, etc. The middleman is mostly engaged in trying to do the *responsible* thinking for those two —and such thinking is almost the hardest and highest priced work there is;—so usually he doesn't actually do it (*can't*, in many cases), but simply gambles, and nature takes the cost out of him by spoiling his goods in some way. And for reasons so obvious as not to need statement, although the chief ones have been stated, the government is less fitted to do that thinking than are the people more directly concerned, and government participation in the affair will not only theoretically increase that cost of ignorance, but in recent practice painfully did do so. The only solution of middleman costs is responsible thinking—plain, old-fashioned gumption or intelligent and active self-reliance (including some in the middleman himself). —— Marshall broadly states the principles of this paragraph in his Book IV, Chap. XIII (he has difficulty in being definite about the One and Many—specifically, the infinite regress); but his extended *application* is fine.

p. We may definitely come back to man and woman. Clearly, in order that there may be a division of labor so that all persons shall not try to do the same kind of work and so in practice destroy the race, it is necessary that persons be necessarily quantitatively different (that is merely the reverse aspect of incommensurability): we ought not (as a figurative truism) put square pegs in round holes. We saw that women and men are the two natural divisions of the race for such a primary division of labor, or general specialization. So if we take a married couple as a standard universe, there is naturally a specialization of jobs; *but*, that specialization can not be *complete* in practice (an attempt at it gives line organization, or too much organization, Pauline pseudo ethics, and a burned-up couple). I. e., the man must "compete" a little in being rather feminine, and the woman must exercise some in being rather masculine. So obviously, generally, and in agreement with practice in this country, there should not be any particular line drawn as to what jobs are for men and what for women. A woman would be about as useless and misplaced in a life job as a professional philosopher as I would be as a governess. But although some women complain that they are barred from industry, etc., I think they could get a job as philosopher as easily as I could one as governess—and I am not aware that any cruel person is stopping me from being a governess. In most jobs a woman can not get as much pay as a man, for the simple reason that she is not so responsible or reliable:- her intellect is as a rule not so dependable, as seen; and also, she is not expected to stick to the job, but is expected to marry (and if she does not, or does not get some other job which mostly uses her superiorities, she is naturally correctly judged to be a somewhat wasted and spoiled human being, not of great value). Nobody would be likely to stop me if I *experimented* at being a governess; but I would justly receive an amateur's pay and fame. If I tried to make governess-ing my life work, I should naturally expect to be considered a fool for wasting my other abilities in order to be a mediocre governess—*but*, if I thought I would accomplish really more as a governess, I would stick it out and prove the others to be the fools. The same principles apply to women; I should expect a woman who tried to be primarily a philosopher to fail to do nearly so much as she would in more suitable jobs; a number of practical failures are available as evidence; and I would unhesitatingly call any young woman who started out to be a professional philosopher a fool. But I would not otherwise try to stop her; maybe she would prove me wrong, and make a success at it, in which case I would conclude both that she was a biological sport, and that the female properties were changing faster than I expected. In the meantime, if I were hiring philosophers I shouldn't pay her more than about half what I should pay a run-of-the-mine male one. —— That general principle of utilizing the properties of people applies to all businesses and all partnerships. It is simple to use our broad, "natural" formula *Emotions...* × *Intellect...* to classify all persons on a *comparative* scale beginning with high intellectual strength at one end and going to *comparatively* high emotional superiority at the other (the difficulty is to guess reasonably accurately where a given person belongs on the scale; also, there is *another* scale of *intrinsic* measures of at least equal importance—e. g., two men may have a good balance of the two strengths so far as it is possible for a male to have, and yet one man may intrinsically have fifty times the strength, power, drive, assimilative-outputing capacity of the other). I used man and woman because they naturally tend to occupy the respective ends of that comparative scale, and thus automatically enter into the widest specialization *combined with* non-specialization:- marriage (which is thus an extreme but sound type of all businesses, in opposition to the unsound line organization). (That 'comparative' scale is the *extensive* factor, and the 'intrinsic' scale the *intensive* factor of the rigorous theory of human measurement. Obviously they can not be separated; but I shall not go further into the mathematical theory; see Index, "Harmonic periodicity.") E. g., of two men, one is more enduring intellectually [perhaps not perceptibly so] and unstable emotionally than the other; so in a business the intellectually strong man should be given a thinking, planning, investigating, imagining, talking, or salesman job; while the other should be in an executive, managing, conserving, buying, organizing, steadying-flywheel job, with general mild wet-blanket duties to counteract the other and make him more useful (and that obviously won't hold if the intrinsic measures of the two differ widely; in that case the only satisfactory way to get an *actual* democracy or sound business organization, is to put the weak man in a position in which he

is not expected to give continual reactions; a pygmy can't wrestle with a giant satisfactorily to anybody, and no business title or other hocus-pocus can make a pygmy into a giant; to expect a manual laborer, who usually has the nerve development of a child [cf. army tests] to tell Ford how to run the business is a ridiculous travesty on democracy or any other aspect of commonsense; *but* the laborer is competent to say what he thinks about his own job, and such remarks, which he has obvious democratic right and psychological need to make, although they probably mean something much different from what they actually say, are valuable to the greatest business genius). *And* actual people do not fixedly occupy a constant place on those scales; they change. —— That is the general theory of all business or industry, or of handling men (including women). It is the definite application of democracy, which explicitly notes that men are not quantitatively equal. Handling men is the greatest of all jobs because it is the hardest:- requiring responsible thinking (of course including estimate of measures), and then application of that to men (which requires more intrinsic energy or drive than they have, at least in the affairs concerned). Housekeeping, including handling a husband and children, is truistically just as hard. Usually the actual objection that is found by women to housekeeping comes from the fact that women who object are too mediocre to grasp and-or intrinsically measure up to the possibilities of the job.

q. So the fundamental practical ethical and-or economic error a person can make is to fail to find what he is quantitatively fitted to do, and then to fail to do it. The average proper job for a man has been seen to differ somewhat from the one for a woman. So in general the economic doctrine of extreme feminists, tacitly or explicitly to the effect that women ought to be given the same work as men, same pay, etc., is wrong. Mrs. Charlotte Perkins Gilman's "Woman and Economics" seems to be the leading "authority" for that extreme feminism. The book is the sugar-coated picture of a matrimonial establishment which actually is what is now usually known as an apartment hotel (male real estate investors took the hint that many women wanted thus to duck hard, life-giving responsibility and supplied them with their Utopia—at a price). Her man and woman do the same sort of work [i. e., they have vaguely a "career"—nature not specified, as it would have been distressing to be too intimate with responsible work], and return at night to glance at the children, who merely vaguely happened, and are in charge of an assumed-competent nurse [who more or less materializes out of the nowhere, and who rather seems to be of neutral sex]. It is a "lovely" picture. The glaring practical defect with it is that in her grossly amatuerish way she substantially forgets that the nurse and the more hidden domestics who run the apartment hotel and the children, are parts of the race; she substitutes them as zero-counters for mothers, in blissful disregard of the multitude of actual economic facts involved. Obviously, her book, as economics, is merely silly. What it means is that she wants to eat her cake and have it too; and naturally a person showing such dense ignorance of fundamental economic principles does not even know what real cake is—what a sound woman can get out of life. Her book is typical of many such female books.

r. Finally some men may object that they do not wish to become any more like women than they can help. —— The characteristic which is probably most commonly named as the essential *masculine* trait is courage. And that is truistically correct:- for courage is the outward result of *conscious* knowledge or intelligence, and can be possessed only by those who have consistent, sure, stable intelligence and the intense emotion needed at any given time to back it up—live by it, or stick to it. We are afraid only when we are ignorant; when we are not fairly sure what is going to happen we worry, which is minor fearing. And obviously, a woman would not have as much courage as a man.[170r] Often men admire the patience of women to the degree of holding that women have more courage, or a better sort than men; I am inclined to be that way myself. But that simply means that those men are more or less conscious of a deficiency in patience: for precisely speaking a woman is usually cowardly with respect to the unknown or unpredictable antics of a mouse, or a washing or other sort of machine, etc.; but they have much

[170r] Roughly speaking, a man is said to have (noticeable) courage only when he is actually afraid of the immediate unknown Many, and, with a little make believe, pretends not to be afraid—or, perhaps to speak more precisely, forces himself to go on in spite of the actual and inevitable fear. (His capacity for intense emotions truistically gives him that courage in a degree superior to a woman's; as a rule the woman can't concentrate her whole nervous system to that pitch of *intensity*, or conscious sticking point.) If we knew everything, courage would then disappear with all other things into the ineffable One, and we would have infinite courage or zero courage, just as it pleases us to say. So the courageous man actually intellectually grasps a very wide sort of God or *Meaning* (he may call it "carrying on," or "playing the game," etc.), and makes it work backwards, to pull him over the fear of the immediate unknowns he will never be able to know accurately (e. g., the common saying that soldiers become "fatalists" means that they thus substantially consciously use the One more frequently than other people use the same thing under the name *religion*). —— So it is a truism that the braggart (who is verbally a truculent, militaristic, aristocratic bully) is not especially courageous; he actually is either make-believedly whistling to hide his fear and exaggerating the hiding of it so much as perhaps to be hypocritical and thus prove that he is too much afraid; or else he is so stupid and dull witted that he is unable to see that there are unknown things that ought to make him pause a bit. Usually the militarist is a mixture of both, and too stupid to see that he is exhibiting some cowardice. But he always exhibits cowardice by expressing the earnest desire that people load themselves down with arms and armor so as to be "prepared"—to protect him, presumably. That glaringly contradicts his "war-like spirit," and much-advertised courage. So it is a truism that the worst objection to the militarist is the directly human one that he is too cowardly—is not quite a man. (Or, if he is not actually afraid to be without increasing protection, then when he says it is needed he is either stupidly parroting someone else, or is lying for some selfish purpose of his own —both of which are higher grades of cowardice.) —— Of course, there is such a thing as a foolhardy ignoring of ordinary prudence—the question of armament is a quantitative one, and the reader will have to judge for himself. Truistically, the best defence against any variety of bully or militarist is to have a well balanced, self-reliant nervous system. —— It is now obvious that the truly courageous man is the one who in numerous things in practical life has used the valid logic soundly. So all the unusually reliable men and women mentioned in footnote 167b are obviously also courageous. Most of them have shown easily observable courage in various ways; so such objective evidence in turn proves the principles here. And clearly, the supreme courage is that possessed by the real leaders of the race —is that courage which with full consciousness of the risks run will unselfishly, without demand for, or any certainty of, payment for themselves, support *others* in right-doing. This book is verbally a trifle novel in spots, and I have found that it takes truly courageous persons to admit that they approve it (the argument is so self-evidently true that I have never seen anyone try to attack it; and apparently people accept the book as substantially correct, so it clearly is simply a matter of their courageously facing the "unknown," the slightly novel, and either standing on their own feet and taking it, or running away). So for some years I have had an unusual opportunity to gauge people's real courage. And I find a surprisingly large amount of it in this country—and a negligible amount in Europe: there they occasionally blow-up prominently with some half-baked radical idea, but there is little steady, hard working courage. Of course, there are numbers of persons in this country, occupying nominally important positions, who are painfully timid; I have learned to recognize them pretty well (mostly by their large and important sounding talk, which is very cock-sure in tone, but vague as to specific facts): some day I may publish an interesting list of them. —— It requires no appreciable courage, of course, to work out and publish or support ideas of our own. Even if the ideas are silly kind nature usually keeps us from seeing it to a fatal degree.

"courage" of the sort called *fortitude*, which is patient endurance of the disagreeable and somewhat passive acceptance of the unknown. The equation tacitly used is *Fortitude or bravery...* $\times$ *Courage or bravery...* = *Courage, etc.* —— So truistically, the more a man knows about women the more courage he has, or the more masculine he is. And he can know about them only by becoming more like them—getting a better balance of that equation. The exaggerated males, with too much specialized courage and not enough fortitude, are the masters, superiors, "bosses" of their wives (who publicly exhibit their condition by following their lords a trifle in the rear, like little dogs); such aristocratic, bullying, militaristic males, from the time of the over-masculine Greeks down to the pre-war Prussian military bully, have been over-emotional, sentimental, cruel, brutal, and treacherous—and have invariably been soon licked and wiped out by more balanced men. A person with so much male courage as to be pathological is called a sadist: with pathological feminine endurance or fortitude, a masochist (often the sexes reverse in that highly exaggerated psychological unbalance). So the man or woman who labors under the delusion that it is nice to achieve large quantities of the respective braveries—who disdains to be a little like a woman, or a man—should read some of that highly unpleasant sex psychiatry, and see what will happen to him or her in some degree. So we see that there must be temperance in democracy or division of labor—especially in the great "natural" one of sex.

§171. a. The summing up of ethics or sociology or economics is known as *art* (when mostly 'outer' or objective), and *culture* or *civilization* (when mostly 'inner' or subjective).

b. It is generally held that art is the method by which things are best done—*art* being there substantially a relationship word. So truistically that which most perceptibly fits with its environment, is most obviously related to it or identified with it, is the best art—*art* there being the corresponding Many word. The One word for art is usually *beauty*. Clearly the universe is completely related or absolutely fitted together, and so is absolutely beautiful:- *Environment...* (←*Art, or relating*→)*Objects of art...* = *Beauty, or Art.*

c. Those definitions of art make it commonplace, normal. Any easily perceptible moral or balanced action or the result (mental or material) of such action is art by those definitions—or, when in some less degree, is skill, skillful, efficient, workable, useful, etc. So *art* as a Many word tends to refer to things out near the normal limits of activity (Fig. 163b); we use other names for quantitatively less things. So obviously, if we speak of anything as being artistic it usually means that it stretches our nervous system so far away from the balance that the thing gives us in some more or less perceptible degree a rebirth. And hence, when used as a One word, *art* more or less consciously means religion, with the added meaning that art is definitely *any* sort of summation into the One: religion actually is that (§166e), but in practice "religion" usually means only an ethical summation —the word *ethical* then being restricted arbitrarily to human actions. It thus appears that the almost interminable disputes as to what is art and what is not, and as to who is an artist, and the value of art, are due chiefly to the facts (1) that the word is used almost equally often as each part of the Trinity; (2) that art tends to refer to matters near the normal limits, and there are no agreed-on measures of those limits (or even any conventional recognition that the disputes over art refer to such quantitative matters); and (3) that because art gives religious rebirths, the priests and the artists are in competition so that exploiters in both classes have deliberately added to the confusion (there are many examples; e. g., Mohammedan theologians forbid some arts).

d. But clearly there need be no disputes about the *theory* of art. That theory is identical with the principles of morals represented by Fig. 163b. But until fairly definite measures are made in humanics there can be no reasonably definite standard of judgment as to whether a given thing is artistic. If art in the Many sense be taken as things in the narrow zone of doubtfully pleasant, just below the painful or pathological zone, then obviously there are only narrow limits of tolerance within which things are art, and what is art for one person may easily and often does lie entirely outside that zone for another. Quantitative judgment as to the zone in which a thing falls is called taste—and obviously there can be no intelligent disputing about taste until such time as we have systematic human measurements. But by means of that theory many prattlers about art may readily be shown to be persistently self-contradictory and hence to have negligible taste.

e. We can readily make a thing quite true or consistent with the universe (ultimately, it can not be otherwise), but at the same time make it so abnormal—so far outside our everyday balance—that we can stretch to it, vividly grasp its actual consistency or have a rebirth from it, only if we make a painful effort. It would be art to us if we grasped it. But by ordinary standards it is not worth grasping, just as it is scarcely worth while to strain to see the beauty in the late Kaiser (§25c), *if* our purpose is to see *beauty* directly; if we have a wider purpose, such as to solve the question of the beauty of the whole universe, he is an excellent detail to puzzle over and sharpen our wits on, as he is so confoundedly ugly at first sight. A highbrow drama is an example of such over-high "art" that ordinarily is not art, but an offensive abnormality. I can get various rebirths from Ibsen's plays if I work hard enough; but I have to supply from myself so many of the relationships that the abnormal Ibsen omitted or erroneously denied, that the result is not worth my work, except occasionally as an intrinsically worthless rebus in the puzzle column to sharpen my perceptions on. So by my measurement Ibsen was a brain-sick man, and not an artist.

f. Because art generally implies exercise up to the painful limit (C or C′, Fig. 163b), the average artist seems to fancy that the more he stretches the better artist he is—that he ought to be abnormally strained. He then has the "artistic temperament"—and is wrong, as we saw in discussing genius (§159f). —— Artistic stretches are usually considered to consist only of stretching *Intellect...* to see the One —to be 'masculine.' But obviously, it is just as real art to stretch the activity of the emotions; and truistically, by this whole book, the highest art is a well balanced amount of both (and of course it is impossible to separate the two—run either to 0 or ∞). The masculine way is commonly called artistic or literary *idealism* [a considerably different idealism from any of the philosophical meanings], and tends to be general, abstract, and impersonal. The second or feminine way is *realism*, and tends to be definite, concrete, and personal. When a man tries to be a thoroughgoing realist he obviously (to me at least, and in theory—unless he happens to be too feminine) makes an awkward, unconvincing mess of it—actually evolves a rather disconnected list of things. (There is a modern tendency for realism to mean any kind of obscenity—a dualistic disconnection of any things from their fitting place and use; —that is the pathological exaggeration of things, especially obnoxious in the hands of the females who do it, as they can go further.) —— Although it is explicitly considered by usual conventions that art should primarily be intellectual, the good artists instinctively make the balance of intellect and emotion. Then the second raters try to copy that, and exaggerate, the men overdoing being realists, and women vice versa (e. g., Mrs. Atherton's books); or, the second

raters do not know enough even to try to balance themselves and so exaggerate their own sex properties (e. g., Wilson's obscenely autocratic exaggeration of ideals in his "New Freedom," the very name of which implies that he alone knows about that ancient idea). Henry James is a good example of a "realist"—giving thousands of rather useless details, making us work hard to coordinate or unify them. And that is not realistic art at all, but masculine intellectual gymastics, which is usually as damaging as having to go out and aimlessly walk ten miles for "exercise"; some people do it, of course, and say it is fine—thereby furnishing considerable evidence that they have not much of importance and real interest to do. In consistency with that principle I have several times told the reader that he need not burden his memory with the details in this book—that they are not art, not particularly fitting and useful, for anybody but the specialist whose business and interest it is to work with them. So that realism of the highbrow or Henry James and Walt Whitman type is not art, but a conscious straining after art that is overdone. (Incidentally, Whitman seems to me to be as large and gorgeous a bluffer as Paul, and not a democrat but a hobo aristocrat; I tend to become intemperate when I point out Whitman's painful abnormalities, as only thus can they be fittingly described: so I omit statement of the evidence). —— Extremely good examples of balanced art I think are Dorothy Canfield Fisher's "Understood Betsy," which at first glance seems to be idealism so simple is its realism, although it probably inclines toward realism, and Gerald Stanley Lee's "Crowds," which at first seems realism so fully does it show in vivid detail just what the great human generality or ideal, democracy, is. The artistic equation clearly is *Realism...*$\times$*Idealism...*=*Art, or Aesthetics*; and if a piece of art is sufficiently great it has both the factors smoothly joined, like the universe, and conceals its art by giving us a grasp of the infinite regress without making us work too hard. Such first class art is thus so simple and commonplace in its details that those familiar things catch the observer or reader or hearer of the art, and push him out to grasp the rest of the universe. Thus all good art is an obvious and readily graspable solution of the One and Many. A good picture makes us understand and be God by suggesting the unbreakable relationship of the universe. And a good machine does precisely the same thing. Obviously, for both factors of that general artistic equation the formula *Style...*$\times$*Substance...* (§166q) holds, and we need some training in *Style...*, logic, method, form, tricks of the trade, or whatever we call it, before we can fully appreciate art. And the volumes needed to expand that science are omitted at this point.

g. Truistically, when a man or a people becomes boastfully and ostentatiously "artistic" it is a symptom of either degeneracy or crude ignorance. The commonplaces of life are beautiful or artistic, and the normal man needs very little of what is technically art. Too much art is precisely the same as too much food, and leads to the same degeneration that too much prosperity of any sort does. The person who 'consumes' much art, and claims he appreciates it either has prodigious assimilative capacity or is a hypocrite (§155)—usually the latter; which agrees with the well known facts as to the intemperance of dull and sodden aristocrats in art.

h. Culture or civilization or progress is obviously a summing up of all art, considering art chiefly from the spiritual aspect, or taking it to be relationship. So clearly culture is a continuous growth of all things (usually considered from the ethical point of view), which growth must, in a fairly steady climate, take place as the result of stretching a little more in our cycles, but no more than can be happily endured *by the majority*. A person who *has become* "cultured" (who, e. g., is "finished" in a "finishing" school) is obviously not the possessor of real culture. —— Because *culture* is such an inclusive word, naming the change in all our personalities and rather explicitly in some of the environment, it is clear that it is not very precise to say that one person differs from another in culture. Such words as *culture* and *civilization* may be called exaggerating words, or spread-eagling words. They are so inclusive that even as Many terms they tend to mean too much, and to elude the grasp of the strongest mind; so it is more sensible to leave them to demagogs, aristocrats—vague-thinking persons who are fond of large words. The man who claims that he is highly cultured or civilized (or, what amounts to the same thing, that he is a member in full standing of a highly cultured nation) is truistically claiming that he is in a great number of things quantitatively much superior to others. Nearly all of us are superior in some things to other persons: I can wash my own face much more satisfactorily to myself than can any other person. But a sweeping claim to superiority is usually grossly inaccurate; and unless accompanied by some definite evidence of its correctness is properly held to indicate egotism—a mild form of insanity in which one's self is over-estimated.

i. The pre-war Germans summed up their dualistic, materialistic errors in their Kultur, claiming a high superiority for it, and congratulating themselves on possessing it. They considered it substantially finished, and that it was their duty to impose it on others—which is the usual theological missionary spirit (see remarks on butters-in, §167j).

j. And finally we see that art and culture, like religion, tend to become ritualistic—and then of course cease being anything more than a comfortable, resting play or less intense imitation of the real, vigorous thing. When Homer made the "Iliad" the most vigorous minds of that day were stretched and trained by it in a fine balance for that age: it made them grasp the universe or God in a fashion, starting with what they were familiar with—it *was* the current religion. But nowadays the "Iliad" is so narrow that it scarcely stretches the perceptions of a child. And its former familiar or simple 'realisms' are no longer full of implication-ghosts and so truistically do not serve as good starting points from which to grasp anything; and the poem's argument is very much out of balance when compared with our everyday morality—with our more delicately balanced standards. So truistically the "Iliad" is not real art *now*; as a fact, it bores me, as it does others I have questioned. But because it formerly was the highest art (I readily see the now practically dead reasons why it was), many people have been made familiar with it and now do use it as a *ritual* art thing, and get some pleasure out of it, and possibly even very mild rebirths. In precisely the same way people get even more than that out of a treasured lock of somebody's hair, etc. That hair is not art now (in its day and place it was better art than any man-made technical "art"). To most other people the more or less dead hair is a little offensive—"trash," from their personal point of view. So, to me from points of view other than the historical and of sympathy with the people who actually like it as a ritual, the "Iliad" is trash. About three-fourths of the Bible is similarly trash to me—some of it quite offensive. And to me many of the "Old Masters" and other antiques are atrocious trash from the point of view of art. I see no great objection to those things being used as art rituals by those who wish. But reasonably sensible people are well aware that numbers of those who praise the Bible, those old masters, etc., are merely hypocrites. But in spite of the danger an honest person thus runs of being classed with the hypocrites, there is an advantage in using the old art first to develop on, "cut one's teeth on" (provided we omit the

immoral ones such as "Jack the Giant Killer" and much of the Bible). For the old ones that still remain decently balanced by our standards have had enough merit to survive the judgment of many men; and "modern" works are cluttered up with pathological puzzles such as Ibsen and Whitman. —— What actually happens is that the good of a great work becomes assimilated into our body of knowledge (becomes a part of our "physical" bodies, in fact), and the unsuitable parts die—change into something else. No work of art in a Many sense can survive in a perceptibly distinct form (§152f). So the moral man will take his art temperately:- using what is good both of the old and of the new—avoiding spending too much time on playing with easy ritualistic art, and avoiding the unbalanced "Art" which, like the poor aristocrats, we have always with us—that "Art" being in fact the product and pet of such aristocrats. And truistically ethics, or what is quantitatively right and wrong, changes with time, just as does art. We have to be similarly temperate as to ethics, or its sum:- culture.

k. It therefore follows, as the sum of this chapter, that the *majority*, which rules in any sort of democracy (and actually rules throughout the universe, as a principle; and *perceptibly* rules among the people of this earth if they be considered over a long time—even though their governments be called autocracies, etc.; XIX)—that *the majority is always right* FOR THE GIVEN TIME AND PLACE IN WHICH IT EXISTS. That is obviously a mere truism. We may apply it with reference to this book, and thus see its evident truth, and the use of the principle. —— This book is mostly a brief formulation of what the vast majority of people have worked out in the past and handed on to us, and which we tacitly believe and act on—act upon so nearly completely, in fact, that in some cases we have forgotten how to express it. So the book substantially accepts majority views as being right in most cases; I personally rest in secure and serene contentment upon the fact that our ancestors saw things as I do. ("Communion of saints" is the queer theological phrase naming that serenity coming from the conservative way in which we act; the phrase implies that the majority, as thus symbolized by the previously accepted good observers, rules; and the phrase is grateful to us because it delicately implies that we too are equal to those great men—as in fact we are, when we thus accept and use their teachings.) In short, I substantially agree with the vast majority of the dead and the living: that truistically is equivalent to saying that I love them and love myself. But, after getting on that sound foundation with most other people, in some rather negligible ways (say to the effect that the earth is cold inside) I stretch a trifle further than others do, and get a few lesser conclusions that are in the minority. Now, I have deliberately endeavored to keep on that majority base while I stretched, and thus to have perceptibly connected those slight minority conclusions with the majority ones. (The aristocrats, especially the tribe of fanatic Artists, try to jump up off that base, and *stay* up and be "superior.") I may be right in those slight minority conclusions; I of course think I am. *But*, those conclusions are not yet right for the race. They *may* be actually wrong: what I took to be consistency with the sound majority base may be a defect in my brain—for I often make mistakes. And even if those few minority conclusions are correct, as a glaring truism they can not be used by the majority until the majority at least see that they are true. So they are not right in a practical or Many sense for the majority until they can stretch up to them and make them a part of *their* conclusions. Although I may be quite right from a broader *L*, and especially *T*, point of view, I most assuredly am "wrong" for the majority here and now until they can at least see that I am right: for as a truism (to repeat it again, as many people do not see it), the majority can not usefully, safely, or morally know or apply my minority conclusions when they do not *know* them. (So truistically all views that it is possible to rule by fiat, by "passing a law," are obviously merely silly.) I would be right in a minority conclusion *in the long run* if the conclusion is right; for then others would have time to hear of it, discuss it, verify it, and acquire skill applying it, and it would then, after a time, be a majority conclusion (even if *I* didn't formulate it, the universe would shortly pound it thus into people via somebody else). —— In short, education has to come in as a relationship between me as a minority individual in regard to some minor views of mine (and everybody is in some respects similarly in the minority), and the majority, before any improvement in precision of balance, or "advance," will work. And *then*, the majority move ahead together. *The majority...(←Education→)The individual or minority...=Democracy, or a Republic.*

l. So I as an individual may be emphatic in this book at times—be "individualistic"—in stating my occasional slight minority conclusion. But I obviously am not "fighting" the majority, or considering them "wrong"; nor do I feel any resentment if they do not instantly agree with me. In fact, it literally would be deadly dull for the majority and for me if we did agree completely: I enjoy the reaction or *formal* opposition in the mere quantitative matters in which we vary, and I am not in the least "polemical," or impatient, or trying to impose Kultur on anybody. So from a broad basic view, I am not particularly disturbed if you have not got sense enough to see that I am right; I will even take *your* point of view occasionally and agree that it is perhaps I who lack the sense. —— And that shows how it is that only in a democracy can there be rather intense *individualism*: it is not a paradox, but simply the circularity of the democratic equation in valid logic. —— The majority is always right *at the time*. And truistically the majority judgment is always wrong when a considerable period of time is included, as things change. And of course a minority of one theoretically always *perceives* first such change as in fact exists. But usually the minority of one who *thinks* he perceives a change is mistaken—or even if he isn't, noisily exaggerates the size of the change. So you must ask minorities for clear *proof*.

m. And the majority is credited with hitting a head that sticks or stretches up above the crowd. As a practical working rule in the past, it was advisable. Possibly we may now safely make a distinction. I admittedly stretch up above the crowd to or in a few little minority conclusions (some will say the admission exaggerates the facts: I am consciously exaggerating here for verbal clearness). But with just as much emphasis as that with which I stick my head up, I keep my feet on the base, and promptly pull my head down and ask the majority to stick their heads up and verify what I saw, assuring them that the view is pleasing and that nothing there will hurt a moderately vigorous person (of course some timid stick-in-the-muds will call me a liar, as R. S. Woodward in clear effect did for several months; and numbers of rubberstamps will say to get somebody else to do it first, as in effect Stewart Paton, W. W. Campbell, etc., did tell me). It is a reciprocal game—the democratic game. To change the figure:- you hold me up to see, and I tell you where to look, and hold you up to see. You held me up first, unconsciously to yourself, and now I have simply come down and offered to hold you. As I said, that democratic game may be a safe game to play now, but I have indicated some men who in effect didn't think so. All the aristocrats, bosses, "authorities," demagogs, have pretended to jump up off the "common" earth, and stay up, above the "herd" or majority,

"superior" to them; or else those pluralists had a trifle more sense and recognized that the "herd" was holding them up, and asserted that they were *privileged* or *divinely appointed* to be held up all the time—that it was *essential* that they be,—whereas it obviously was merely quantitative. So the majority cracked their heads as a practical solution.

CHAPTER XIX. *Sociology and economics.*

§172. a. The theory or principles of democracy (§§167-170) is the theory of sociology:- simply that all society, regardless of how it is considered divided into parts, reacts as our general machine *That*...×*This*.... As noticed, the only difference between ethics and sociology is the quantitative one that sociology includes the consideration of as many people as we care to mention, distributed over as wide *L* and *T* as we like; whereas ethics is tacitly taken to be more restricted, and hence tends to be confined largely to our own selves. Truistically, it is not essential that ethics and sociology consider only persons, and in practice they do not strictly do so, but confine themselves mostly to persons, thus being an extension or application of psychology. When those sciences are *explicitly* quantitatively extended to include some of the environment, often under the technical name *wealth* (including money, property, etc.), they are called *economics*.

b. We have seen (chiefly in §168b) that ethics, sociology, and economics may be represented by suitably selecting names out of this extended equation:- *That, or Neighbor, Spouse, Others, Environment, Climate, Employers, Capital, or Supply*...×*This, or Ourself, Certain given men, Employes, Labor, or Demand*...=*Meaning, Happiness, God, Real Life, Cooperation, Democracy, Society, Industry, Commerce.* And for the × or relationship sign we may substitute these relationship names in various conventional ways:- activity [or (←*Activity*→); see §168b], action-reaction, cause-effect, love, payment or labor-wages, or payment in any material or spiritual way, loyalty, education, etc.

c. So I necessarily gave the principles of sociology and economics in the last chapter, in giving ethics. The quantitative, Many application of them, if it were given in enough detail to include rather useful everyday facts, would extend to volumes, and must be omitted at this point. And I must omit reference to important facts about existing foreign governments, etc. [172c] So I shall merely show in principle and scientifically that the Constitution of the United States is a general valid statement of democracy, and is substantially in agreement with natural law, and then make a few general further applications of sociology and economics.

§173. a. The total Constitution is an explicit assertion of a *That*...×*This*... Many machine, or democracy—as we now begin to see. The preamble repeats in six conventional ways that the total purpose is to establish *explicitly* a relationship, or love, or a mutually reacting machine. I. e., the preamble explicitly names the × sign as being six conventional names (all of which are implied to be *identical* [§28h] by the first):- (1) The preamble names the × sign as being "more perfect union"; the body of the Constitution gives the conventional names of the *That*...'s and *This*...'s, and the preamble primarily asserts:- *That*...(←*Forming union*→)*This*...=*Union, or United States.* The preamble thus, by the use of the phrase "more perfect" troubles grammarians, but soundly *implies the infinite regress.* The Declaration of Independence with bombast and cock-sureness ignores that infinite regress. —— (2) Then the preamble states that the Constitution is to establish justice. That is the legal or juridical term for balance or temperance between all *That*'s and *This*'s; *justice means reciprocal* love or *payment*:- *That*... (←*Justice, or Payment, etc.*→)*This*.... —— (3) The next synonym for the universal relationship which gives democracy is "domestic tranquillity." That, even more explicitly than "justice," asserts that no painful departure from the balance is desired—that no fanatical, radical, pathological activities or persons of that sort are desired. That is a purpose clearly in full consistency with the ethical principles that oppose all aristocracy or excess. —— (4) Then the Constitution is to "provide for the common defense." That obviously recognizes the possibility that other nations may (*un*lawfully, in a "natural" sense; i. e., in some degree insanely) try to depart from a natural, mutually self-preserving balance with this nation, and hence in a dualistic, wrong fashion, *aggress.* (A formal, legal, logical establishment of the correctness of this part of the Constitution is omitted here; footnote 172c). Then, if there is such aggression, the language clearly provides that this nation may defend itself. We saw (§164d) that that is fundamentally moral, or in agreement with natural law. But *the Constitution does not in any place provide for aggressive war*; therefore, as aggressive war is national aristocracy or insanity in some degree, it is unconstitutional to declare any but a defensive war—which truistically is a war against an aristocratic nation which perceptibly attacks us first. The next paragraph is a parenthetical one which considers that, and its implications (which are of importance). —— (5) Next, the preamble purposes to "promote the general welfare." That is an assertion that the people in general are to "progress," or to become more and more civilized. It obviously explicitly asserts as a purpose of the Constitution all the remaining natural ethical laws stated in the last chapter. —— (6) Finally, it purposes to "secure the blessings of liberty to ourselves and our posterity." That is a sort of One summation of all the other purposes, as liberty or freedom is usually a monistic term (§169). —— So it follows that the Constitution (if its body adheres to the principles laid down in the preamble—as we shall see it does) is

[172c] The explicit reason for doing so is that I am a retired lieutenant in the Navy, and Federal law limits my speech in certain matters (see "Navy Regulations, 1920," issued in accordance with Sec. 1547 of Rev. Statutes of U. S., by the last administration, Arts. 113, 100, etc.). The last manuscript version of this book was written under that Wilson gag law, which was in keeping with his make-believe "pitiless publicity," and I had to make some queer looking omissions in order to conform to the law. But the new administration substantially abolished that gag law in a general order, June 14, '21. The only restrictions I can find in the law now that affect this book is that I am not permitted to comment on our foreign policy (I couldn't have done so anyway, as nobody has confided it to me; but I have refrained from guessing what it may be); that I am not permitted to comment on foreign governments; and that I am forbidden to praise or censure other persons in the Navy. I had no desire to censure anybody in the Navy at present (Wilson, the late commander-in-chief, is no longer in the Navy); so the law has cut out some specific praise. I have had to dodge mentioning foreign governments: nothing in this book is intended to refer to any existing foreign nation or government, except insofar as such is merely remotely and unspecifically implied as a naturally inseparable part of the universe. That of course makes odd blanks. And there are traces in the book, which I haven't succeeded in revising out, of obedience to the Wilson gag. I once wrote a version which declined to obey the Wilson gag as unconstitutional. But it later seemed better taste to obey it (i. e., all American citizens were responsible for the law, and I could scarcely be courteous to the reader and flatly decline to obey his wishes, as expressed by his legal representatives; so in the later version I made that null-law ridiculous by temperately obeying it). The present law seems to me sound—but if I were to say it is needed I would unfortunately imply that there were foreign governments so aristocratic as to be unbalancedly touchy (§169h), even to the remarks of an insignificant individual like me: so I refrain from even the non-particularized remote implication that such a government or people may now exist.

with extraordinary completeness and explicitness based upon and in agreement with natural law. I know of no other explicitly stated legal law which has such completeness and definiteness of statement. In fact, as shown in the next paragraph, the Constitution is naturally valid law which not even yet, after over 130 years, is followed in its principles by lawyers in their pseudo science of the law, which adheres to the classic logic and dualism and is wrong.

b. A positive legal or statute or lawyers' law is, according to the lawyers ("Ency. Brit.," Art. "Jurisprudence"), a command or order "set by a sovereign [or *superior*] person, or sovereign body of persons, to a member or members of the independent political society wherein that person or body is sovereign or superior." All rules or natural laws or principles which are set and followed by men living in a state of nature [i. e., without a "sovereign"], or which are set by "equal sovereigns" [i. e., all international law], and all those rules in a state with such a superior but which rules are not explicitly ordered by the superior, are themselves not laws in that lawyers' sense, but are or accompany anarchy (ibid., p. 572). So truistically, orthodoxly the lawyer's law, and his so-called science of the law, is logically a step by step, premise on premise, affair that proceeds in only one direction—is classic, dualistic logic in legal terms,—that can not consider or formally admit mutual interaction, or any real science of action and reaction, or any democracy, or be finally circular and actually provable like valid logic. The lawyers' law requires a superior, an aristocrat, and denies that a state of natural interaction or democracy or *That...×This...* can be law, but explicitly asserts that it is anarchy, or an absence of positive lawyers' law. —— It therefore is obvious by this whole book that that *strict* theory of lawyers' law is wrong; that it is flatly contrary to the Constitution and to all true rights and morals; and *is unconstitutional for this country*. So truistically a lawyer *by his legal theory* is incapable of correctly interpreting the Constitution, and in general is not competent to interpret any law validly. For, in keeping with that legal theory, *strict* lawyers must hold that if there is a doubt as to what a law (or also the juridical acceptation of a custom or practice—a "common law") means in a given case, the doubt must be settled (1) by a careful and strict investigation and interpretation of the wording of the law; and failing that solution the doubt must be settled (2) by interpreting the law as having the intended meaning of its promulgators, as historically given. In short, strict lawyers recognize only the superior sovereign, and attach infallibility to his (their) word or presumptive word. But it is obvious by this whole book that such logical or juridical infallibility is impossible: no word can be given an exact meaning, and all meanings of words change with time, and there is no possibility of historically determining exactly any intended meaning (in fact, frequently the sovereign, instead of being superior, was ignorantly unaware of what he did mean). So the only rational way to resolve a doubt as to the meaning of a law in a given case where there is self-contradiction or omission, is to make its meaning "balance," or agree with natural law, in as close agreement as possible with the wording of the lawyers' law (the judge should not be permitted to depart further than that from the code, as such further departure constitutes that pernicious juridical legislation for which the orthodox pseudo theory, while exaggeratedly claiming the opposite, actually serves as a cloak or make-believe; see footnote h:—and a practical suggestion is obvious:- that the judge be required to report clearly the omission or self-contradiction to the legislature—that giving a *method* by which the judge and legislator can democratically work together if they have enough intelligence, instead of often conflicting). I. e., *interpret the defective law "reasonably,"* and thus eliminate any impossible and confusing hope of the infallibility of a non-reacting or non-democratic "sovereign." Obviously no other practical method of applying the law is actually possible. In legal practice that law of "reason" actually is followed, as the unescapable laws of nature force at least its unconscious acceptance. Our investigation hence sums up into the simple rule that it should be followed consciously and so with less bungling and pettifogging.[173b] So by natural law or morality or commonsense (and also by the plain statements of the Constitution itself), the sum total of the Constitution provides for a healthy, natural democracy, and implies that it is unconstitutional to declare an aggressive war: and Amend. X, which

[173b] All that, as explicitly stated, gives the strictly orthodox legal *theory* of jurisprudence. It hinges on the conception of sovereignty, as seen. But that theory of law has been combated by the real leaders in the law since prehistoric times (see Maine's "The Ancient Law"). The article "Jurisprudence" from which I quoted the orthodox theory acknowledges that legal struggle between explicit classic logic and what is in effect our valid logic—between aristocracy and democracy. Our Constitution, as we shall see in more detail, rejects the orthodox classic theory of law. But Marshall, as an early chief justice of our Supreme court, in some degree forced the aristocratic pseudo theory upon lawyers (see footnote h, which also shows how he was wrong and in disagreement with the Constitution). So it is probably the quantitative fact that most lawyers in this country weakly follow the arrogant and physiologically forceful but legally and intellectually stupid Marshall, and accept that wrong legal *theory*. Of course, the able leaders in law have been in effect steadily combating Marshall's autocratic stupidities (Lincoln is quoted to that effect in footnote h). But until a rigorous solution of the One and Many was available the battle was indecisive: now there isn't any battle, and I shall merely read the burial service for Marshall and his quibbling bullies. —— In *practice*, lawyers for ages have to a very large extent openly followed our valid theory of law, and our lawyers to a considerable extent *practically* accept and apply the Constitution. We proceed to see the historical facts in proof. Sir Henry Maine is a reliable authority on such facts, his "Ancient Law" from which I shall quote being accepted by most lawyers (some of course being too stupid to see what he was talking about). Maine tried to enunciate the principle of "reason," or valid logic, or of our constitutional cooperating-sovereignty, as being the theory of law, and did make considerable success of the attempt; but as we just implicitly saw, the "Ency. Brit," holds that technically he failed. But our leaders in law in effect accept Maine's valid theory. —— Maine shows that what is technically called "equity" [etymologically that part of the law which deals with actual justice, the remaining part, or "law," consisting of mere classic logical quibblings] began to be formulated in earliest history on the laws of nature, or justice, or commonsense valid logic, as a relief from the obvious injustices, delays, and stupidities of the classic logic law, which were far worse then than now. Maine (ibid., Chap. II) defines equity (in part) as having its authority grounded, not on any lawyer's "sovereign," but on the nature of the principles to which it is alleged that all law ought to conform [i. e., it ought to be sensible, 'balanced']. It has a higher sacredness [legal sanction] than that of ordinary law. Maine says (III):- "The progress of the Romans in legal improvements was astonishingly rapid as soon as the stimulus was applied to it by the theory of Natural Law." —— Thus it appears that I am saying nothing new, but am showing the valid theory of the law that lawyers themselves largely practice and tacitly accept. Of course, as a truism, if there hadn't been mostly truth and validity in what lawyers actually did, in contradiction to their mere talk, long ago there would have ceased to be any lawyers. So in spite of the emphatic clearness with which I state the sound theory of the law in this section, I am not radical—am not trying to "reform" law. I merely suggest that in practice it would help them to stop wasting time and effort if lawyers would preach what they frequently practice—if they would consciously (intellectually; in theory) accept the Constitution: because natural law will make them in effect accept it anyway. Such acceptance would make jurisprudence actually a science, so that a man could then safely engage in the study of law without danger of debauching his intellect—debauching it so thoroughly that, according to the legal authorities quoted (§163g), it often debauches his morals (which include emotions). Such valid jurisprudence, except for the mere suggestions of this section, must be omitted from this book; but a number of legal leaders have the competence to formulate that science:- e. g., Taft, Hughes, Pepper.

reserves to the people powers not delegated to the government, explicitly makes it legally unconstitutional for anybody but the people to declare an aggressive war. The first important need for that consistent interpretation of the Constitution is:- to announce to everybody that as a nation we will be democratic, and not aristocratic and predatory (the advantages of which are implied below), and definitely and explicitly to make our armament a police force (which solves rigorously the fundamental question in the problem of disarmament, the remainder of that problem obviously being a never-ending quantitative one; §176ef). —— The second and last important need for such a consistent interpretation is fundamentally the same as the first:- the destruction of the aristocratic, dualistic delusion that there can be a superior, capricious sovereign. This consistent interpretation is a general *concrete* destruction of the conventional theory of unconstitutional lawyers' law, showing constructively that the constitutional or legally sound theory of law, as well as the naturally sound theory, is that the people themselves spoke and speak the law to themselves. Specifically, *that constitutional point of view obviously abolishes all orthodox* LEGAL SANCTIONS, or "evils" (ibid., 576) that in orthodox law follow on the refusal of an inferior to [essentially] obey the superior. Those sanctions are truistically a tertium quid or a logical link (§§23-4) invented (in a really impossible way) out of nothing, to make an otherwise glaringly unworkable theory of law seem to weakly-seeing people to work. Of course those sanctions *could* make an infinite pluralism that is formally valid (Part One); but the actual practice of the lawyers is that it is assumed to begin with (and it is a libel against the race—and reacts somewhat on the lawyers themselves, making them into what they say others are, §163g), that humans do not want to obey the laws and have to be forced to do so, and have evils or sanctions threatened them. Sanctions are the lawyers' holy things or idols, like the theologians' dualistic God (see also par. c). —— So "sanctions" give a *negative*, repulsion way of founding law. The negative way is the best first way (Index, "Negative"), and is quantitatively useful with barbarians and present defectives: Moses used the negative way, and most lawyers have not been able to improve on Moses. The Constitution does.

c. The Constitution having thus effected in an extraordinarily able way which is perhaps but slightly appreciated, a complete and valid reversal of orthodox lawyers' law in its preamble—having made in it a succinct statement of valid natural law,—the preamble was followed by the body of the Constitution, in which the various reactions or reacting parts are definitely named. As that was a Many or quantitative procedure obviously it can never be exactly perfect. And that practical existence of the infinite regress, or of the fact that there can be no exact science, was provided for in *three* explicit ways (which indicates the framers' practical recognition of the importance of the principle):- (1) Art. V allows amendments. (2) Amend. I provides free speech, and specifically freedom to assemble peaceably and criticize the government and talk back to it. That obviously means that nobody in the democratic nation was to be assumed to be infallible, or essentially superior, even officially, or to be so superiorily wise that he could safely do without interaction with his fellows. It also means that the founders of our nation were not afraid of adverse criticism—that they were sufficiently men to have the courage to take it, however much they humanly disliked it—were sufficiently past the infantile stage of mind growth to be aware that they sometimes made mistakes and could be helped by criticism, and were strong enough themselves to tolerate tranquilly the intemperate speech of the few inevitable unfortunate defectives—in short, were cognizant of the advantages of free speech and strong enough to pay the price for them. (3) The Constitution chiefly is concerned in specifying the acts permitted to the government, in the formula *People...* × *Government...*, *Government...* (or more precisely *Government officials...*: *government* of course constitutionally includes *people*; but I verbally generally use that conventional abbreviation)—*Government...* being the intensive factor and truistically most emphatically and explicitly talked of. But Amend. IX ("the enumeration in the Constitution of certain rights [of the people] shall not be construed to deny or disparage others retained by the people") explicitly provides for that customary and necessary verbal vagueness, and allows the regress in *People...*. We saw in the second sentence in par. b that lawyers assert that such natural rights or ordinary laws of nature are not laws in a legal sense, but are anarchy. The Constitution here contradicts (or legally abolishes, if that face-saving phrase is preferred) that barbarous legal pseudo principle. So if this Amendment means anything that is recognizably consistent with the ordinary meaning of the words it uses, it means that the rule of reason is to be used, and that the orthodox legal "procedure," stinking of sanctions, is interdicted.

d. The remainder of the Constitution names the various practical *This*'s and *That*'s which must be definitely put together as a machine in order to achieve the Constitution's general purpose of obtaining a democracy, or general *That...* × *This...*. The Constitution merely keeps on at that process until it becomes reasonably certain (for the time being, at least) that no clever exploiter or legal grafter, or other species of defective, can find a verbal or "legally" uninterdicted opportunity to run some *That* or *This* far out of balance (without check other than the natural limit). —— But as direct evidence that it is not practically possible to rule by fiat, we just saw that the sweeping interdiction or "law" enunciated by Amend. IX against the pseudo legal theory and procedure has not yet worked, after over 130 years, because the majority of the people have not insisted that it be definitely complied with. So there is no magic in the Constitution, even though it is an extraordinarily valid statement of democracy, to make it work unless people want it to and *themselves* do it. —— But the Constitution as at first written and amended seriously failed to be sufficiently explicit in providing such a balance, in that it did not definitely assert that there could be *no* (legally) *fixed classes*, such as "superior" owners and their slaves. That defect, in view of the fact that some slave owners insisted on being essentially aristocratic, inevitably brought on the Civil war, as such *fixed* class distinction was not only naturally immoral, but was in direct violation of the stated democracy or varying *That...* × *This...*. That war corrected the deficiency, which truistically would not have caused war, but would merely have produced an agreed-upon amendment when the point was called into question if the rule of reason, and not the lawyers' dualistic procedure, had been followed. (Of course, numerous sorts of exploiters supported the lawyers in their short-sighted procedure [par. f]; they still do—as otherwise such silly verbal quibbling could not last. Please do not understand me to fancy that lawyers unsupported could maintain such a monstrous barbarism as their unconstitutional theory of the law. Also, a lawyer has to deal almost invariably with defectives *who don't admit defectiveness* [with criminals who more or less can't, and with litigants who are usually so angry as to have judgment so defective as to want to fight, which strictly speaking makes them *out*-laws or mildly insane by the Constitution]; so the lawyer has an enormously difficult job to handle his clients and not become like them, with a fighting or unconstitutional procedure. A physician's patients admit defectiveness; yet

he has trouble avoiding the *acknowledged* danger of becoming like them. The dyer's hand, etc.) —— Similarly, the Constitution does not now *with complete explicitness* assert a perfect balancing; it is impossible that it do so in a finite time, as such would require the complete assertion of the infinite regress. Several possibilities of further explicit balancing by further amendments are sometimes suggested:- e. g., one allowing Federal divorce laws; and one definitely forbidding willing of wealth *unearned* by the legatee, as such bequests arbitrarily disturb the natural balance, and also fail glaringly to give people equal natural opportunities. But, truistically, *if* we follow the rule of reason, and the Constitution's own explicit general enactment of such a balance, we can never have another civil war. (And personally, I think we would better add amendments *very* sparingly; if we haven't got sense enough to get along by legislating under a reasonably steady basic law requiring us to keep balanced, we aren't likely to acquire sense in the process of making a jellyfish of it.) —— But, e. g., at any time that the lawyers and their exploiting supporters undertake to uphold *persistently* (cf. §169d) the orthodox, unconstitutional legal theory of law, we truistically sooner or later shall inevitably come into another civil war. The Constitution as a *statement* of law is valid and natural law (the best rules and instructions yet made, for the biggest game ever played, and of interest to those who can understand them—we are all *in* the game); but even that soundness can not of itself mend deficiencies in men's nerves or souls. Our own dynamic daily majority *use* of the principle of the Constitution makes it work, and keeps us out of civil war and lesser troubles.

e. We need not here notice all the *That*'s and *This*'s balanced by the Constitution. I shall state the chief balances as being enough to give the general principles of its practical workings. —— The chief balance is in providing for the election of the important government officials more or less directly by the people, with *limited time* of service in the cases needing it (par. h), and explicit means of removal in all cases:- there was definitely established, with explicit *L* and *T* measures, the formula *People...×Government...*. That explicit mutual control or interaction of people and *arbitrary* Many government (*not* the absolutely sovereign government of the dualistic lawyers' law) obviously formally, and *legally in a constitutional sense* even if not in a lawyers' sense, removed all fixed, aristocratic governing classes—eliminating orthodox sanctions, fiats of superiors, etc. The places of power were limited in time, so that even if their incumbents went power-mad, they would automatically shortly be removed, before their power-mania had time enough to grow much or do much harm. That principle of time measure is an exceedingly important one in practice, and might profitably have a volume devoted to it. Anyone will go power-mad if given a little more power than his character or nerves can stand (§168l); similarly anybody will go insane if given enough food so that the excess poisons him enough (nature often kills completely in that case before the insanity is long apparent). Power does not usually kill quickly, and many men are seen in places too large for them fattened or swollen up with pride, "dignity," and various sorts of queer and sometimes dangerous unbalances. (Such "swelled heads" occur in business; but they rapidly kill the business.) Any excess, all *prosperity*, will unbalance a man if it measures a little more than his particular endurance. Prosperity and poverty are perceptible departures from the balance. They make a man stronger if they do not pass into his painful zone (Fig. 163b). But if they just pass into that zone they accumulate a fatigue or poisoning, and truistically destroy the man if not removed soon enough. A little power thus always makes a little, weak man show himself to be such by making him perceptibly unbalanced or ridiculous. Usually he begins to show it by being "dignified" and pompous (like many men who have similarly slightly poisoned their nervous systems with alcohol); then he becomes either too secretive, or too talkative—usually mostly the first, although there is often a cyclic rotation of the two, as in the case of Wilson. After that the symptoms are very variable, approaching paranoia and similar insanities. The "newly rich" are over-prosperous in money. —— We can observe power-madness in many different people. The healthy young have a normal physiological cockiness, with a belief that they could handle some big job without going mad; but if we are older we doubt if we are big enough to take Lincoln's job and stand quite steady although we may not be afraid to try. So the Constitution sets a time limit on power, to save us and to save the man given official power.

f. The next balance in the Constitution is the abolishment among the people of all *fixed* classes (i. e., those without a time limit—in full agreement with the natural law that there are no physical *constants*), by interdicting titles of nobility (Art. I, §IX, 8; §X, 1). That makes an *always* variable or natural balance:- *Other men...×Any given man...*. The same sort of balance is further obviously explicitly extended *inside our nation* by more or less prohibiting bills of attainder, the suspension of habeas corpus, ex post facto laws, internal tariffs, and all internal privileges or "preferences" (Art. I, §§1X, X; Art. IV). Then, in further explicit assertion that the "rights" or dots of *Other men...* (or *Bodies of other men...* or *States...*, as contrasted with the intensive factor *Government...*) could not be fully stated in those internal balancings, Amend. X ("The powers not delegated to the United States by the Constitution, nor prohibited by it to the States, are reserved to the States respectively, or to the people") supplies that explicit statement, and clearly and definitely makes our formula for all the people, *including* government:- *States, or other people...×Government, or given people...=Union, or Democracy, or Republic.* Obviously, there is a beautiful natural validity, and *definiteness*, about that general internal balance. —— We may note the illuminating fact that as soon as there arose a dispute over the right to have the dualistic, fixed classes, owners and slaves, that dispute as to balances would be identically or synonymously expressed by putting it into *any other That...×This...* form. The first form that is *wider* than *Slaves...×Owners...* is *States...×Government...* (named "states' rights"). The problem of plain slavery was too easy to solve if kept in the simple human terms *Slaves...×Owners...*: many aristocrats could not blind themselves to the fact that there were not many perceptible "blessings of liberty" for the slaves. So those exploiters evaded in the age-old way—putting the problem into larger or wider terms to confuse the issue, and in some degree to hide their own wrongness from themselves (a sort of reverse make believe). (I speak with no animus against former slave owners, but sympathetically give simply the obvious facts: my own family on both sides lost their slaves by the Civil war.) Clearly the problem of slaves and the problem of states' rights are identical in principle. To assert that states have a right to withdraw from the union is equivalent to asserting that there exists a right for men to *try* to separate and become fixedly apart, just as slaves and owner are (nominally; but impossibly in fact). Such an assertion is also in direct contradiction of the *contract* made in the Constitution, which requires the assent of both parties to terminate. No such assertion will ever be true (except in a quantitative sense, when men degenerate and are quantitatively unable to hold together in as large a union as now; cf. §176). Always exploiters will try to put

that same simple principle of the Constitution—balanced cooperation—into wider terms. But with a rigorous solution of the One and Many we shall be very stupid if we get confused and exploited. Quite often in history the Monroe doctrine has been given an imperialistic, aristocratic interpretation by the dualists; but as the reader may readily see that by writing a few formulas we will not go into it; also, see footnote 172c.

g. The Constitution thus made first a balance between government officials and the remainder of the people; and then a balance between all the parts into which the people were arbitrarily or conveniently divided. In short, it explicitly abolished privilege, or aristocracy, or unearned power or other unearned perquisites. And it did not do that in any sweet, sentimental, vague way: it got right down to definite measures, to *L* and *T* science, to "brass tacks," with such precision that it worked pretty well. The Constitution is science of the highest order. And as it was made by the whole people it is another indication of the fact that the important average or majority judgments of men are sound.

h. Then the Constitution proceeds to the details of the government officials. It makes a balance of executive and of legislative branches, relating them by the judiciary, thus:- *Legislature...(←Judiciary, or Jurisprudence→)Executive...= Government.* The Constitution, in the absence of its makers' specific knowledge as to relationship terms, is a trifle vague verbally or formally as to the judiciary; but it obviously asserts that formula, which implies all the sound principles. *The judiciary in reality has no power in the usual sense*, but is merely a connecting link or relationship that interprets, or makes each branch 'perceptible' to the other. The judiciary is the sociological governmental Holy Ghost (in wider sense, "public opinion" is—represented mostly by the press). The judiciary, *having no power*, is hence, so long as it attends to its legitimate and constitutionally allowed business, and keeps away from holding the lawyers' law, truistically in no danger of becoming power-mad; so with implicit recognition of that, the framers did not put a definite time limit on the terms of judges. Obviously, the business of the judiciary is to say what is truth; the *truth* has what is commonly accepted as one form of power, that of "prevailing"—i. e., of simply being, or existing:- as the ultimate relationship of identity (§28h). The press has "power" only as it tells the truth. The judiciary and the writers *as such* truistically have no power: insofar as they are diligent in finding truth and honest and skillful and courageous in giving it to others they are good workmen and deserve high payment—*and that pay* which is then theirs to spend is their power. *But*, as we see below, by unconstitutional lawyers' law the judiciary is the *agent* of a superior sovereign, and as such *has* power (both delegated power, which ultimately is the only sort anybody can have, and the nominally first-hand power of in effect legislating). —— If the lawyers do not agree that all that is true, then they automatically assert that the judiciary should be given a term limited in time or else terminable at will without cause by the sovereign (and they also automatically assert that their job is not to find the truth and state it, etc.). I am quite aware that Marshall in effect disagreed with the view that the judiciary has no actual power constitutionally; by so doing he proved himself a poor thinker and incompetent judge. To give crucial evidence of Marshall's errors:- He (together with the notoriously aristocratic imperialist Hamilton) held that a state is sovereign in a lawyers' dualistic sense, and can not be sued without its consent (Bryce, "American Commonwealth," New York, 1908, p. 235). That view truistically makes the judiciary the agent of the sovereign and thus gives it power (which as a matter of history and common law—which common law the Constitution in direct effect enunciates as law—was long ago in England forcibly taken away from the judiciary).[173h] —— And in general proof of all that, in direct legal terms, the Supreme court, before Marshall was on it, with ordinary commonsense and reason, decided that the Constitution did *not* hold a state to be thus sovereign (Bryce, ibid., 235). As a result of that, and probably of Marshall's and the lawyers' and exploiters' dualistic views, Amend. XI was added in 1798 ("the judicial power of the United States shall not be construed to extend to any suit in law or equity commenced or prosecuted against any one of the United States, by citizens of another State, or by citizens or subjects of any foreign State"). By that states have *in practice* repudiated their debts, and otherwise acted as a capricious "sovereign" in an immoral and unbusiness-like way—like a robber baron, or a dead-beat kaiser or pauper. According to its *practical* and to its customary *legal* interpretation, that Amendment is the one blot or error in the Constitution. By the Constitution (strictly interpreted: see below), and by all natural law, no state is absolutely sovereign; neither is the Federal government; and so *constitutionally all are liable for damages for any mistakes, and subject to suits.* (To admit that would be simple

[173h] That interpretation (that he considered the judiciary the agent of the "sovereign") is the most charitable opinion to take of Marshall's views; and I have adopted it because I haven't bothered to read much of Marshall's autocratic dictums. I am inclined to believe that the historic fact is that Marshall was much more unintelligent and irresponsibly lacking in knowledge of jurisprudence and its history than that mild opinion indicates. I am inclined to think that he was, with customary irresponsible, aristocratic power-madness, trying to make the judiciary into the orthodox lawyers' "sovereign." And that seems to be the customary view of Marshall's exploits. That "sovereign" status of the judiciary was historically nearly an invariable phenomenon in all races of the Western world, where aristocracies which claimed to be the depositary and administrators of the law succeed "sacred" kings (we call that the buying up and capturing of the courts by the rich). And they all regularly failed to work and broke down (Maine, "An. Law," I), the people demanding that the law be written in codes. And that dualistic and naturally unworkable pseudo judiciary is explicitly provided against in the Constitutiuion, which gives the legislature the duty of enunciating laws (so that it is none of the judiciary's business to legislate), and the executive the duty of examining them and sending them back for reconsideration (if thought needed), and of executing them. So obviously, all that is left for the judiciary to do is to discover and state the truth (so far as it can) regarding those various matters (unfortunately, the Constitution speaks of judicial "power"; but obviously, no meaning other than 'duty to speak truth' can consistently be got from that carelessly used word). —— Marshall could have discovered that legal history if he had tried; and a trifle of intelligence would have made it clear to him that this present statement of the nature of the judiciary as a truth-stater is the constitutional one. But actually Marshall wasn't a judge at all: he was a grabber after power—essentially a robber baron, a kaiser, a bar-room bully. —— So by direct implication—by directly assigning the power elsewhere,—the Constitution prohibits the judiciary (practically, the Supreme court) from issuing any binding or compulsory interpretation or fiat as to a law's constitutionality. The judiciary can merely try to show the congress and executive that a given law contradicts the Constitution in principle, if it thinks the law does. As we have seen, any matter of principle can be shown rigorously, and so clearly that a child can see it. So if the judiciary can not show congress and the executive that the law is wrong, and have them repudiate it of their volition, then the law is a law. (Of course, if there is a frequent conflict of opinion in such matters, and recalcitration, the government would come to a standstill; but the practical solution is obviously for the people to throw out all its officials, including impeaching the Supreme court, and get some representatives who haven't gone power-mad.) —— Lincoln clearly saw the substance of all that, and stated it at his first inaugural (quoted in J. T. Richards's "Abraham Lincoln, the Lawyer-Statesman," 170):- "If the policy of the government upon vital questions affecting the whole people is to be irrevocably fixed by decisions of the Supreme Court *** the people will have ceased to be their own rulers, having to that extent resigned their government into the hands of that eminent tribunal."

good business and elementary morality and constitutional law.) Now, by referring to the wording of that Amendment it is at once obvious that the aristocrats did not state openly or definitely what they apparently were trying to get:- the legal right for a state, as absolute sovereign, to repudiate, shirk, any of its acts or contracts (the Constitution repeatedly interdicts that lawyers' pseudo principle that "the king can do no wrong," or the pope is infallible, etc.). The Amendment does not give or state such a legal right by its words, but is merely a legal evasive statement of such probable intention on the part of the grafters, but undoubtedly not the intention of the majority the grafters pretended to represent. So it is not necessary to repeal that Amendment, for it can obviously be interpreted justly thus:- upon the request to the Federal government of any person who has been refused redress by a state acting on that pseudo principle, the Federal government may, in strict accord with this Amendment, and must, by the rest of the Constitution (and by all natural law and morality), institute a new, separate, and distinct suit of its own against the contract-breaking state for damages to the public welfare, etc. By such good Constitutional law those repudiating states would undergo on their own motion a quick and permanent change of heart, and pay what they still owe. Also, such practice would educate lawyers as to what the Constitution both says and means.

i. The expansion of details of the last paragraph must be omitted. We can merely note the most essential fact:- that the Constitution explicitly provides a democratic or balanced-cooperative government or organization of officials, and not the line organization that we saw was flatly wrong in principle (§§37f, 167). The next section implicitly shows the meaning of that. —— Another important explicit agreement of the Constitution with natural law is that Amend. XVI allowing graded income taxes is a *definite* recognition of the democratic or moral principle (§§167-8) that men are not equal in a quantitative sense. That same principle is obviously implicitly recognized by every definitely quantitative statement in the Constitution. And that Amendment is obviously also competent practically to stop inheritance of unearned wealth (§168mn), if a definite basic law is needed.

j. That makes the Constitution an enactment of all natural law and moral law—except perhaps it does not definitely assert the morality of economy of time (although the whole of it does promote economy of time, as is implied in the next section), and except that Amend. XI is practically a blot and should be eliminated.

§174. a. Many people hold that in practice democracy or the Constitution does not work well. E. g., Faguet thinks so, and gives such views emphatically (and what he fancies is proof of them) in a book called "The Cult of Incompetence" —his name for democracy. Many hold that the Prussian autocratic type of organization *gets things done*, while democracy can not—that democracy muddles along in a chuckle-headed way, and wastes, and wastes, and wastes. We have seen that theoretically autocracy, or the line or king or sanction type of organization is absolutely wrong and can not possibly exist in reality. For, autocracy requires theoretically an absolute superior to hand down orders without there being a reverse, equal reaction ("Theirs not to make reply"). Autocracy tries to go to infinity—*claims* in *theory* that it does. Socialism goes in the opposite direction from autocracy—to zero, in its impossible dualistic or equally aristocratic theory; i. e., (as we see in §175) it theoretically has *nobody* giving orders (or as everybody is explicitly a government official, the government is 0 or ∞, just as we choose to say). Obviously, in a *strict theoretical* sense both socialism and autocracy are impossible (Part One; specifically, Index, "Increase of entropy"); and the two are essentially identical (as 0 and ∞ logically are the same), merely going in opposite directions. But if we take the two in a *quantitative sense*, as species of actually existing organizations which therefore truistically do not strictly go to those extreme limits that in a Many or actual sense are impossible, then necessarily the two are merely attempts to depart, in the two respective directions, from the balance; see Figs. 104b, 163b. So both are persistent intemperances or aristocratic, and both are immoral and kill. Democracy is obviously simply the temperate mean between the two. We shall look at some of the practical details of that very simple principle—that of *That...*$\times$*This...* or of *Socialism...*(←*Democratic reactions*→)*Autocracy...* (cf. Fig. 104b). —— A more or less autocratic ruler (no absolute one is possible) will usually get a thing done in a shorter time than a democracy will (if he gets it done at all). But it is not done so well or so completely. If he *keeps on* for a while getting the same thing done, its accumulated deficiencies in completeness of being done (in L, formally) will amount to its not being done. Or, the autocracy will blow up, go to pieces, change into another sort of structure (cf. recent history; and change of structure in Part Two resulting from any persistent accumulation of potential).

b. A reasonable general conclusion is that those who prefer, or fancy they prefer, having things done in a somewhat autocratic manner (we of course repudiate absolutely the impossible absolute autocracy or line organization), are those who tend to be somewhat impatient, and imagine that *they* could do things a lot better than other people (they are likely to take that "radical," autocratic view if they have never done very much themselves: young people and labor leaders are much affected that way in practice, while often verbally make-believing with opposite-direction socialism). But all of the conspicuous autocrats in history so far have failed (gone power-mad and made quite a mess)—from Alexander down to Wilson, who made an extraordinarily good ruler for war, where an autocrat is needed.

c. In democracy there is recognized a mutual natural (i. e., inevitable; see Part Two) interaction between parts of the Many. When two people in a democracy thus cooperate the first tells the second what he wants in the way of reaction. As there is no exact science he can not possibly tell the second *just* what he wants—he can *not* give an accurate or completely intelligible order or 'law.' So, because the second has a recognized right (legal *and* natural) to react, he assimilates such part of the order as he can, and reacts with (1) an 'objection' to such part of the order as he thinks is unfitting (is not as accurate as he can make it, or thinks he can), and with (2) a question as to what other parts of the order mean, if he fails to understand them. Truistically, *every* order must theoretically (because of the infinite regress) have a part that is thus objectionable and a part unintelligible. If we are dealing with a keen man *he will definitely perceive such two parts of each order*: if we have a "thoroughly disciplined" soldier of the docile Prussian type, whose business is "not to reason why," then his mentality or soul or nervous system has of course in some measure been destroyed by that "discipline," so that he will take an order as being "perfect"—as coming from a divine-right superior. Then, in our democracy, the first cooperating man after giving an order considers the second's objection and question, and revises the order if desirable. And that action-reaction continues until *both* are sufficiently intelligible to each other and in agreement, to get the order done properly and well, to the satisfaction *of both*. It takes more time, of course. But the two men are helping, each the other, to get the thing done so that it satisfies both (so far as it was practicable for them

to go along in the infinite regress), and so they both grow and are conscious of living—are happy. —— On the contrary, an autocrat will in "first class" militaristic fashion bark his order at his theoretical slave (who in a "first class" line organization is frequently definitely admonished *not to think*:- all autocrats try to keep the "lower classes" ignorant; e. g., the Catholic church used to bury people alive for reading the Bible—"Ency. Brit.," xvii, 891). And then the slave very promptly—"on the jump"—goes in an unthinking (i. e., more or less dead) way and does a poor job which he does not understand or care for very much. Of course, an imbecile or even a horse can excellently perform some few trivial orders well—such as March! or Halt! Obviously, the longer such orders are barked at the slave, the more stupidly he performs them, and the more narrowed he becomes—except for the occasional toughly enduring one who steadily dislikes them. Also, the autocrat who barks them misses most of the possibilities of learning from the other person: the autocrat does not have to think much (thinking is hard work; so his order that the slave do not think is actually an order that the slave do not by thinking force him—the autocrat—to think:- "theirs not to reason why, theirs but to do and die." [174c] Finally the slave (perhaps in the third or fourth generation) sees that he is being deprived of most mental activity, and that there can be nothing worse to fear; so he then fails entirely to obey the autocrat and kills him—and usually take on the job of being autocrat himself. In the previous process of carrying out the orders he has learned more—the autocrat merely pushed the button, and truistically the longer he is an autocrat the more incompetent he becomes. So even in that autocracy there actually is a reaction. It is the final reaction of the slave's killing the autocrat—in that violent way taking his turn at objecting and questioning. After many such fatal cycles, in a steady climate both autocrat and slave learn to see better, and with such mental growth learn the advantages of less violent ways of getting things done. So obviously, in the autocracy *in the long run* advance in doing things properly is *slower* than in a democracy. But in an autocracy *particular* orders are executed with far more speed (provided they are made trivial or detailed enough—such as the orders for marching through Belgium in 'steen volumes, none of which worked well), but with steadily *de*creasing "morale" or life or happiness or effectiveness. —— So in a democracy, if it is agreed, as in the late war, that for a while it is imperative to get things done quickly even though a bit poorly and unintelligibly, then such autocratic barking will produce at once extraordinarily effective results (and incidentally a large crop of the power-mad, composed of men who have to be entrusted with imitation money or authority). But obviously, that sort of autocracy can not continue and produce good results; truistically the incompetency would accumulate until the whole thing blows up (e. g., the last election was the slaves' present-day moderate way of eliminating the power-mad Wilson, who ran a fine autocracy). An autocracy (also, a socialism) is the sociological get-rich-quick scheme.

d. It is thus obvious that aristocrats—kings, military autocrats, priests (with their identical-twin brothers:- socialists or savages; §175)—have been a necessary stage in the growth of the race or advance in civilization. They violently emphasized—at two extremes—that there was more life when there was perceptible social organization (or division of labor; §170). So they proceeded to make classes, or divide labor—probably back in the prehuman stage. Naturally they did it violently, crudely, coarsely—by *our* standards; but they were doing excellently by universal standards. And that lumbering, slow-moving, nearly imperceptible, and usually *verbally* denied democracy has, after a million or more years, become our conscious democracy.

e. In a democracy a thing can not be done to the *complete* satisfaction of both parties to the reaction (par. c). The democrat truistically has intelligence or "life" enough to see that, and 'object' (we see the incompleteness of our actual

[174c] Obviously, it is the *work done under such autocratic or line organization* that is the sort of work objected to by intelligent people. Clearly, that sort of work is what has given "work" most of its bad name; that sort can not be anything but painful and degenerating and debasing if it accumulates enough. For its characteristic truistically is that its need or use or place in the universe, or its relationship, *is not perceptible* to either the worker or the autocratic boss *in a sufficient degree*. Usually the worker knows less about its wider relationships than the boss; but the boss in turn knows less of its minor and internal relations, so he is subject to the same drudgery and discontent—as the inevitable result of not acquiring competence at the job by using the democratic way of learning it. —— There is pleasure and joy in all work if its relationships (finally, its religious character) are seen; it is a normal rebirth (§166e). So the way to eliminate the sort of work which is objected to, and to eliminate the demand for shorter hours and other labor troubles, is (1) to educate the employer (and his agents) to stop being autocratic, and (2) to educate the employe to stop being a more or less willing slave who is too lazy to think and keep at thinking. Because of the infinite regress that simple and obvious principle will never be perfectly applied and we can never finish trying to apply it better. I shall give a few details of its present application:- Primarily, labor in general are mentally children, compared with employers; their leaders are usually men with very strong emotions and courage, but are deplorably weak and untrained mentally and hence short-sighted, and truistically unable to use any but autocratic methods themselves (the top leaders are of course honest; but many of the lower ones are too stupid intellectually to be honest). Ample evidence of all that, and of other quantitative facts I assert briefly here, is in the newspapers, and reports of investigations, trials, army tests. The majority in this country have tacitly long recognized that incapacity of labor, and have treated them as a class something like minors (not a *fixed* class: any laborer can leave the class in either direction simply by evidencing changed size; obviously, the whole Constitution consists of dividing people into classes, into *This...* and *That...*, but explicitly *not* into *fixed* classes which disregard *actual* size or worth of men). I. e., the majority substantially exempted labor from keeping its contracts, from abstaining from conspiracies, and from keeping the peace. Now labor has developed into a strong, overgrown boy, and the majority are finding it necessary to class labor legally more and more with adults—and labor, like most boys in that condition, is complaining, and demanding that people "stop pickin' on me." Of course labor should still be granted some of the legal privileges and immunities granted to immature persons—but fewer, as they *in fact* grow. —— The "one big union," the I. W. W., and the "closed shop" ideas are obviously the same:- an effort to make labor sole dictators, autocrats, or the lawyers' aristocratic "sovereign." Of course it is wrong: but I rather think it better wisely to "ignore" the labor-children in that matter and let them wrestle with that problem of autocracy themselves; the rank and file of labor are suffering severely from the autocracy of their leaders, which naturally gets worse in the degree in which they succeed in getting closed shops, etc. Of course the rank and file should be shown what sort of power-mad baby-czars they are suffering: and legal measures should be taken to see that employers who do not care for the closed shop, and the public, are protected from the unions' breaking the peace; and that the unions keep their contracts. There should be temperate, non-autocratic labor unions, of course. Some reasonably strong organization of labor is needed by employers to keep them reminded of the fact that *they* must not be autocrats. I think the facts are that most actual employers today are intelligent enough, and have enough self-control, to act democratically—and do do so fairly well *themselves*; the actual difficulty is that the larger ones have to delegate much of their job to agents (managers, foremen, etc.), and those agents haven't the capacity to be democratic—and it is a huge job to impart it to them. —— Finally, as employers are quantitatively superior in most of the characteristics that make a man valuable in industry, then by the principles of genius (§164db), or free speech (§169h), or democracy in general, employers should let labor make young asses of itself in various ways (as it has been doing) and still be patient and make no more reprisals than they would on their erratic college sons; and by the same principle they should *initiate* ameliorations in the lot of labor *which are just* and *pay*—no charity.

handling of the infinite regress). (So, incidentally, because there is so much conscious 'objecting' or perhaps "divine discontent" as a needed part of democracy, short-sighted people mistakenly conclude that autocracy is better—for in it dissatisfaction occurs as a matter of course and is dully and silently accepted, as per lese majeste and gag laws: "theirs not to reason why, theirs but to do and die.") —— Because of such failure of perfect satisfaction, and objection, obviously one party of men in a democracy are conscious that they can not advance faster than another party; so a conscious balance, or majority rule (§171k) is willingly sought. Nature of course forces an autocracy to keep in balance; but the autocratic pseudo theory denies it, and each party tries to deprive the other of satisfaction (i. e., push it down; the euphemism is:- "keep it in its place"); so naturally, as soon as such people thus stupidly accumulate a violent unbalance, an 'objection' in the shape of a war restores it.

f. So a democracy as a truism of its nature tries to educate its members. Any democratic reaction (cf. especially par. c) is, truistically, education—a drawing out of the vision or activity of each party; which is the reverse way of saying that each party gives to the other love or more abundant life. An aristocracy (autocracy or socialism) is simply a more violent natural or unpremeditated education, and hence is suitable for the callous people who need such violence in order to begin to perceive. The reader will note that our theory does not "condemn" aristocracy, but simply concludes that it is good for those who need it. —— So democracies deliberately set about training the spirits and-or bodies of their children so that they can react well in a democracy. Usually only the formal training is called education. But it would necessarily proceed, when consistently done, as democratic reactions ("work," etc.) of a character graduated to the perceptions and mental endurance of the children—and it would not stop except at death; at a certain stage the apprentice-democrat will be put at producing reactions of immediate use to others, that stage theoretically beginning at three or four years of age, and the apprentice part of it (or stage of *partly* "earning a living") being completed at from sixteen to thirty (in practice, of course, the child begins to support himself more abruptly). That lengthy last sentence generally describes a consistent education: I omit the volumes of expansion. Dewey, in "Democracy and Education," gives an extraordinarily sound consideration of the principles of education which is based directly on the democratic principle—on *That*...×*This*.... The reader can get the rigorous expansion in that book, which I think is the best statement of the general theory of education that has been written—and there are many good books on education. Dewey shows (ibid., XXIV) that the formal subject of education (which he there names philosophy, just as we here name it democracy) sums into infinity or religion—gives a rebirth.

g. Education worthy the name is truistically an "all-'round" education (one that at least in effect recognizes the infinite regress) *which finally gives ability to estimate the measures of men, and hence to react cooperatively with them.* Aristocratic ideas of education considerably neglect that summing up, erroneously emphasizing the need of an accumulation of facts. Just an accumulation of facts is not education—a truism so obvious that I shall not waste the reader's time with a proof of it. —— Democracy gives balanced education, as seen; so circularly, valid education gives democracy. So truistically, a sound education gives ability to be useful to others. It is not a private affair in which the scholar stuffs himself with more or less dead and rather useless classics and then fancies that he feels pleased because he has spent so much time prinking his brain, and is superior in knowing rather dubiously applicable stuff. All facts can be useful, of course (just as the kaiser is beautiful; §25c). So education is measured by its practical or Many usefulness—which is the same as saying that we must apply to it the theory of value (§168). The most definite measure of usefulness is money. So Taylor's principles of educating or management, which insist that at least some money measurement be required, soundly formulate a democratic measuring rod that had been increasingly used by men as they have developed in keenness, delicacy, and definiteness of perception or living.

§175. a. As noted in §174a, *socialism* is essentially the same aristocracy as autocracy: it merely would *strive* to be intemperate by going in the other direction from the balance (Figs. 163b, 104b). Autocracy would go to the extreme Many limit of having one man give all orders, with no reaction: socialism would go to the opposite extreme of having everybody "equal" in the government, so that again there is no reaction. —— There is little agreement as to what "*socialism*" means. I shall give a consistent statement of its possible meanings, assuming that it is different in some way from democracy and autocracy; and if people who call themselves socialists can not find their beliefs included in those meanings, then they are in some degree either democrats or autocrats, and would be more intelligible if they named themselves conventionally.

b. Numbers of high-minded and generally admirable men view the race as being very emphatically an organism, or a One. It is, of course. Then they call that One *socialism*. Or, they name the universal relationship of identity or "brotherhood," *socialism*. Obviously, as a One word, or as a relationship or Holy Ghost word, *socialism* is permissible and sound. But *sociology*, or some such phrase as communion of saints or human equality or brotherhood of man, is the more conventional One name or relationship name. In that sense socialism is of course a synonym for democracy, or for any other of the numerous One words or relationship words—and is of course absolutely ineffable, meaning nothing definite until it is put in positive *That*...×*This*... terms. Many of those admirable One socialists admit that they can not give such a statement. They simply mean that they prefer to be religious in terms of human beings:- *Other men*...×*Us*...= *Socialism, or Human equality* (*i. e.*, IDENTITY), *or Religion*. Usually those men begin to describe democracy as well as they can when they shift to positive Many words; in practice they are democrats, with a tendency to have more faith than the average in the capabilities of government officials—which of course makes them better men than those who have a faith less than the actual facts warrant. —— The objection to such high-minded or religious socialism is that it does not say what it means very well, and so is a cat's-paw for scoundrels.

c. The socialist who expresses himself in Many terms, especially the extreme socialist, usually definitely states his aristocratic belief in fixed classes—and their antagonism. In practice at any rate, his difference from the autocrat is that he believes that *his* class, the proletariat or "working" class, is the "superior," and should rule—and should, as the mildest view, seize all property and distribute it "equally," whatever that may mean. The justification for that is that autocracy doesn't work, and is unjust [that is true; but it does not justify the same methods by a different set of men]. Such definite socialism was mostly made in Germany, largely by Marx—although the idea and practice of socialism is older than the race (see next paragraph). (The technical logical objection to Marxian and Many socialism is that it is materialistic—a dualism so obvious that I won't waste the reader's time with formal statement of it.) —— The reason is obvious why the socialist should fancy himself the opposite of

the autocrat in principle, whereas he is merely opposite in direction and is also an aristocrat:- The autocrat does have a perception of the natural relationship or ultimate identity of men. So he vigorously *does* something about it: he proceeds to organize men, so that they *perceptiby* to themselves get that religion in terms of humanity—and along with that fuller mental life truistically get a higher material standard of living. The autocrat naturally exaggerates that idea and doing, in order to pound it into the duller people, and he shortly reaches the limit of *his* capacity and begins to fancy that *he* personifies the relationship—that being the divine right of kings (and the weak ones he lifted out of animal savagery also highly appraise that great work). The autocrat does act by the idea that if a little is good more is better: but I have trouble myself seeing *in practice* that that isn't so past the point of balance, and nobody can judge exactly where that point comes. A socialist sees that relationship of man, and he sees the autocrat's mistake of going too far. So the socialist thinks *he* can personify that relationship by *talking* about it and keeping everybody from the intemperance of the *other* or more material sort of doing into which the autocrat fell. And the socialist promptly falls into talking intemperately—personifying himself more or less as a sort of abstract mouthpiece of the divine human race. And his verbal intemperance is usually atrocious. —— As seen, democrats try to balance "talking" and "doing"—in practice act on the fact that mind *is* matter. So truistically they are conscious that ultimate relationship, unfailing cause and effect, does exist, and that there is no need to exaggerate either aspect. So democrats do not have to symbolize the divine right of the autocrat or the socialist by a lot of fuss and feathers, a special ship and entourage to get to Paris, glittering uniforms, high masses, the dirty collar and hair of the "high" thinker, etc. The objection to those symbols (more important than the time and money they waste) is that we are prone to forget that they are symbols, and take the idol for the reality. In democracy the real boss or acting person constantly changes, the person who gives the reaction becoming the boss or acting person. (Of course a moderate amount of symbolization of the person who is expected to do certain acting is convenient.) The essential thing that makes red tape be red tape is that a Many formality is erroneously substituted for an existing relationship: red tape is idolatry in trivial things for trivial people.

d. Socialism therefore truistically means in theory absolute government ownership, everybody a government official, and no division of labor. So there is nothing novel about the practice of socialism. It is simply a new name for the way in which "solitary" wild animals live:- Each member of the species (except when nature forces some democracy upon him in the form of temporary family: perfect socialism is impossible) takes what he wants when he wants it (or else fights for it, if another animal disputes the want). He does *everything* especially for himself, *and hence gets all he produces.* I. e., *property is common*; and there is substantially no specialization of work with its necessary reactions or 'law' or 'ordering' between individuals. Each animal is in the "government," holding an office equal to any other (except for unavoidable natural sex, etc.), with natural result that there is no government in any ordinary sense. Clearly, perfect socialism implies (1) an impossible quantitative equality, or (2) the impossibility that two finite beings can not interfere in finite space. But the sincere socialists can join (if I may say 'join') the solitary animals and at once have their Utopia as closely as nature permits. Thus socialism practically is *extreme* savagery. Most savage tribes of men are on the upward path to democracy via a violent autocratic reaction from that worse savagery. —— In a One sense we all *are* in the government, and we all *are* equal (to the universe or God or infinity—which ought to be enough to satisfy a reasonable person), and all property *is* under the government (even the common law asserts that).

e. Possibly no socialist would urge going to the extreme of animal savagery. But it has become obvious that both the socialist and the autocrat are aristocratically fancying that they should (in opposite directions) get a government with *fixed* classes—with of course *fixed* superiority (and its material symbol or measure:- money or property) for his respective class. Both being contrary *verbally* to natural law, each fancies he is *fighting* the other: actually, the two are *naturally* interacting, but doing it somewhat violently and painfully—nature's method of pounding sense through to their consciousness. The democrat is the man with sufficient intelligence to see the actual principle, and to desire a balanced cooperation of *Citizens and their property...*×*Official government and its property...*, or *Labor...*×*Capital...*.[175e]

[175e] Ultimately, all the unbalanced theories of the socialists and of the autocrats are simply a demand for more life, more activity, more "good." Those unbalanced theories are-is a selfish demand—an excessive demand—of ignorant persons for the right to live—for self-preservation. And that demand usually practically takes the form of a demand for the ownership of property—regardless of the disguises it may wear. We saw (§164d) that it is a fundamental law that all of us, as a payment for existing ourselves, must allow others the "right" to exist. So far we mostly have discussed that "right" in terms of *people*—giving democratic reactions between people. But it was definitely stated that the right to exist truistically involves the need or "right" to react with so-called material things. And such things are *property*, as we shall now see (money is the *general* representative or measure of property; §168h). Mostly I have discussed relations with people because people are perceptibly moving and variable, so that the balancing of reactions with them is more difficult than a balancing with property, which is less variable and exacting than people:- land will not usually move away, or actively hit back; and a cow is not so difficult to react with as a spouse. So it is comparatively easy to get the principles of property and keep balanced with property. But that does not lower the intrinsic importance of property in human life. In any normal life it is just as imperative that property be temperately owned and handled as it is that we be temperate in other things. I must omit volumes of details of property: but such details are important, and must in actual life be given an equal place with *personal* or so-called spiritual democracy. —— Clearly, if by agreement we allow the "right" of existence to each normal man, we truistically allow some similar quantitative right to the "material" means of existence:- food, shelter, clothing, etc. Thus we allow a right to property:- for if anyone deprives a man of material air or material water, the man will die; and the same principle applies to all other property *in varying quantitative degree.* Volumes on that variation in degree must be omitted (e. g., just what does a stockholder in a holding company own?). But we may here summarize, and consider the essential part of the right to property:- which is the indispensable right to "own" (i. e., as surely and positively *control*, or anticipate-all-the-reactions-of, as is humanly possible in such a quantitative matter) *land*, that is possessed by each person, and includes the equally indispensable right to some water, air, and produce, that goes with the land. The principle of each person's right to such property is that truistically he has the right in proportion to his own reactive or cooperative measure of worth as a person (with proper distribution as to *T* during his life-time—a huge quantitative subject of pensions, minors, etc., which I omit). If his reactions with other men have a given value or quantity, then as a simple truism he has a right to control or own an amount of land which is the same fraction of the total land (measured by its usefulness or desirability) as his work is of the total of all men's work (measured the same way). So obviously, as the next inevitable truism, socialistic talk about dividing property equally is glaringly immoral, as men are not quantitatively equal. —— That principle of ownership needs volumes of expansion into practical details. The chief need in that expansion is to consider the matter dynamically. One of the gravest troubles men have had has been in more or less accepting the static, dualistic proposition that if a man once gets legal possession that possession becomes a *fixed*, unchangeable fact, an eternal aristocratic "privilege"—so that property accumulates by inheritance in the hands of a privileged few who neither earned it in

f. Men ordinarily are normally at a given time somewhat slightly unbalanced pleasurably either towards more centralization or autocracy in official government, or else towards more socialism. Those varying classes form two natural parties; but it is not possible to give steady names to the two, for as soon as a party becomes too violently autocratic (e. g., the Wilson administration) it automatically flops over or reverses to a dangerously exaggerated socialism. And as both extremes are radical, names of parties tend to reverse—as has occurred several times in our history (and during the confusion a substantial third party arises temporarily). So truistically the most highly moral or balanced man will change from one party to another, remaining always in opposition to the party which is most unbalanced. The intelligent men thus hold the balance of power in a democracy.

g. As a practical fact, Marxian and similar socialists are rather ignorant persons, and fail to see the difficulties of managing a large organization, and particularly of getting one made. They rather fancy that simply to name a man general manager will automatically enable him to run the largest railroad properly—will make him *in fact* a general manager—overlooking the truth that actually generations of toughening and sharpening of nerve fiber is needed as an educative preliminary to prepare a man to begin to 'see' a railroad system. So the ignorant and sentimentalists tend to want government ownership expanded. And there are many selfish persons calling themselves socialists who think that they can manage to grab an easy job if there are enough available—thereby in effect admitting that they expect to see socialism fail. Those socialists are in principle identical with the autocratic politician who in his heart believes that "to the victor belong the spoils." —— On the other hand, the autocrats, with a stupidity going in the opposite direction, exaggerate the difficulties of that job; but by then inconsistently fancying that they personally can measure up to it, at least in prestige, "pull," etc., they insist that it be quietly given to them to be run by divine right. —— *The democrat has to estimate men in fair agreement with the facts*, and steer between those aristocratic exaggerations. Being a democrat is a hard job.

§176. a. So the success of any human organization depends upon the size of men. The limit of the organization here is one man reacting democratically with all the other people in the world, as a perceptible organic whole, or as a world state or league.

b. That single organization would, from the human point of view, chiefly require a man of so much strength that he would not go power-mad; and of such keenness of vision for details that he would not be afraid of too many unknowns and as a result be the opposite of power-mad, and so worry himself into uselessness and red-tape (all autocrats, circularly, have attacks of timid red-tape; cf. §169h). —— Or, the nominal head of the people of the world could be a committee of some sort—a collection of men. However, one man (by the principle that no two men are quantitatively equal) would actually at any given time lead the committee and be the head of the world. But, in the usual committee the men are so nearly equal that no one man can in fact lead for long; so the responsibility is practically divided, with the truistic result that the committee is a socialism, and dawdles along not doing much; and even worse, when the committee is so large as to be called a congress, the nearly-equal members are liable to spend time in childish bickering, irrelevant to their duties, in what is actually a comparison of strength —unless some man is strong enough to sit on them. The advantage of a committee is that if the strongly-working real manager of it goes power-mad he grows weak, and another man in the committee is in duty bound to replace him: the committee-scheme *automatically* puts the proper time limit on its members. A committee is also a device that allows the person or persons who select it to have several guesses as to who is the man able to do the work. So a committee, or triumvirate, or legislature, etc., is *itself* in principle a rather unconscious or slow-moving democracy, which inclines toward being a socialism if the members are mediocre and about equal, and toward autocracy if it has strong members who begin to go power-mad. —— And from the point of view of environment, that world state, if it is to be a fairly perceptible democracy (is to exist in fact), requires that there be sufficient celerity and explicitness of communication, both mental and material, between that one man and the others to enable him and them to act and react perceptibly (and similarly, but in varying degree, between any and all other combinations of men). E. g., if some men steadily insisted on departing from the democratic balance, then that one man must have that fact communicated to him soon enough to enable him to react (before they went far enough to damage themselves or others much)—that being an effort to educate them into a desire to go towards the balance. Then if after reasonable reaction of that sort they continued to act so as to break up the democracy, the communication should be sufficiently good to enable others to see that the recalcitrant or "lawless" ones were defective in some degree, and to have them either restrained, or killed, as expedient. Evidently, communication inside the United States is such as to enable the Constitutional government and the people (who have been trained into sense enough to *use* it) to do precisely that —and do it rather definitely, although slowly in come difficult cases. But I think it is obvious that it could not have been done here two centuries ago. —— So from the point of view of communication, a world state at present will work with some perceptible defects. The principles of harmonic periodicity will apply to it: and so it is quantitatively possible that a world state would be of such a size that if nominally formed it might be out of harmony with other world quantities and break down—with disastrous damage in the exploding. On the other hand, communication is now so good that we already have considerable of the opposite defect:- of being pained because we have messages or things we can send and want to send to others, and there is no organized (definite) agreement that those others will take them. If we arbitrarily get in the way of a world state that by the same principles of periodicity is about to form "naturally,"

fact nor pay for its continued possession (except by personal deterioration and crippling; §168d). Socialism is the natural reaction against that erroneous static view; socialism usually exaggerates equally in the opposite direction. But at the same time even the autocrats usually accepted theoretically the principle which annulled or compensated for that exaggerated static practice:- that the legal owner of property owed continued proportional pay to other people in return, usually called a *tax*. And as we shall see (footnote 176d), owners paid *too much* as taxes (but apart from that brief note I must omit that vast dynamic expansion). The compensation made for their error by the socialists is their personal discomfort and all-'round failure and more or less approach to animal-like squalor, that gives us the valuable evidence that we do not want socialism (as a well known practical fact, as soon as socialists bestir themselves to do something more than talk, the primitive savagery they begin to experience is ample lesson for *them*, and they reverse to a rather extreme autocracy). —— My general guess about property is that there has been and is now an astonishingly just perceptible distribution of wealth; but people's *statements* of the principles on which they fancied they accomplished that distribution are just as astonishingly wrong and self-contradictory—being one long series of emphatic make believes (due to the simple fact that as both socialism and autocracy in practice say they will take your property if they can, it is the part of wisdom—except in democracies, where the reverse holds —to conceal what you have, how you got it and where, and what you are going to do with it, etc.).

we also shall get hurt, just as if we stood in front of a moving train. And as communication (under a steady climate) is constantly improving, that pain is constantly increasing; and we shall be forced sooner or later definitely to organize the communications (establish a world state), just as the thirteen colonies had so much trouble that they substantially had to make the Constitution. It is a question of quantitative judgment as to what we ought to do now.

c. So if we think we can steadily get a man who is of sufficient size (replacing him fast enough to keep him from going power-mad or the opposite, and at the same time being able to leave him in office long enough to learn the job), and if we also think that communication is good enough, and if we think that the various peoples have sense enough to try to react democratically a little (to "hold up their end"), it follows that we shall be consciously conforming with natural law to establish a world state. We of course are already more or less in a world state—in a *universal* state, for that matter (with gravity reactions, etc.). If we had a more conscious, more explicitly organized state, it would truistically give a more abundant life, in terms of cash and everything else. *But* if we pretend to run a world state and in fact do not, we destroy some of our life (unless we have the strength to pay highly for a while for the education, and are able to survive the violent civil war explosions). So if we fail to start a world state at once it is because we are afraid to tackle the unknown and do not amount to much as men, *unless* there is fair quantitative evidence that it would fail, in which case to start it would be reckless stupidity. In that latter case the part of wisdom is to build up a world state gradually for a while longer by more definite treaties, postal and similar conventions, international courts, etc. (which is precisely what the thirteen colonies did for some years, unconsciously acquiring education for the final definite crystallization). —— It is a quantitative problem. No man can be absolutely sure which way it should be decided. I omit my opinion in the matter (see footnote 172c).

d. If it be decided to start a world state, the determination of the *principles* of the organization is easy. They are in our Constitution, and are simply the principles of democracy, or of *That*...×*This*.... There being no exact science, the application of those principles truistically will not work perfectly. —— No man, from his personal or imperfect Many point of view can be satisfied with a fairly just democracy or balance; from such a point of view any sort of fair balance in a world state involves his making "sacrifices." But those are his payments for what he gets in return. We have seen throughout the book that it is impossible to get something for nothing. Because consciousness is life, truistically the intelligent man wants to *know* he pays, and how much; and the *highly* intelligent man (as shown in §§164db, 169h, footnote 174c) wants to *initiate* payment—pay first; sacrifice. We need an apparent digression:- that it is thus rigorously truistic that *an indirect tax* is wrong, immoral, and bad business (i. e., in a democracy; in an aristocracy it is an evil needed to compensate; cf. last of footnote 175e).[176d] —— Most of the people who agreed to our Constitution made sacrifices, and were willing to do so (as is proved by the fact that they did). That is largely how it happened that the Constitution is so extraordinarily good:- it was consciously paid for by everybody, without any perceptible aristocratic privileges being given as bribes—no "log-rolling." To form a world state, various nations would consciously have to pay for the organization at once and would not very perceptibly pay a smaller fraction (speaking in economic terms of concrete wealth). Both those general ideas of taxation (equal fractions; and the weak a smaller faction) are wrong (even with regard to unearned wealth got in an aristocracy by inheritance or grabbing; then the correct principle is that all which is unearned should be repaid). The successful, "wealthy" man in a democracy, usually in justice ought to pay some smaller fraction of the *concrete* wealth (property; money) he gets, than does the less successful, "poor" man. And it is a continually asserted quantitative fact, which probably is true, that the successful man does thus "pay less than his share"—which probably shows again that we *act* better than we say in our make believes. And the way we achieve that probably correct result, in the face of a wrong orthodox theory, and sometimes in the face of actual efforts to make the successful man pay a larger fraction because he is "able" to, is to levy indirect or secret taxes. They of course get passed on to the poor nearly entirely (in ways so simple and well known that the person who is not a fool or a self-blinded aristocratic grabber scarcely requires statistical proof of it, although that can be got from many stock-selling circulars); and that serves to restore a correct quantitative balance. The really correct thing to do glaringly is to state openly that an indirect tax is wrong (fit only for savage socialists and barbaric autocrats, and naturally tending to make us similarly blind and partly dead when used on us), and that we won't use it but will directly tax everybody, taxing the successful some agreed-on smaller faction of their wealth (putting the aristocrats in jail, if such extreme measures are needed to stop their grabbing). —— The rigorous truism (footnote 175e) is that a man should return to society services equivalent to what he receives (that is the truism that action equals reaction, which we have seen is universally true; the orthodox theory of taxation is wrong in that it expresses that truism only partially, as we shall see). Obviously the "successful" man in a democracy (who is not always rich in concrete property, although he usually is nowadays) is one who of his own initiative or enterprise, or at least without being "watched" or supervised by others at the expense of much of their lives, gives all the work or reaction that he can. The successful man gets useful things done: gives better products and methods, etc., that help us all indirectly. The unsuccessful or really poor man is one who fails to give much reaction to others, doesn't like his job or care to do it well, or has to be watched by foremen, policemen, etc. So what he gives to society is meager and of poor quality; but he usually puts energy into demanding good pay, and consequently ordinarily receives much more than his fair share of *concrete* pay—of wealth. So as a rule the successful man has already, before he comes to pay taxes, given proportionately more to society than the poor ones. So he ordinarily should pay a smaller fraction in taxes. It is a quantitative proposition, of course with a few exceptions: the rigorous theory is that the man in a democracy who has deserved little should pay a larger fraction of concrete taxes if (as is usually practically unavoidably the case) he gets a larger fraction of concrete pay. —— And it is clear from the fundamental theory of taxation (the theory of *That*...× *This*...) that the best hope of achieving reasonably just taxation, which next to honest money is perhaps the most important economic balance wheel, lies in taxing people from several points of view. I. e., no "single tax," no solution of the infinite regress involved in taxing a single sort of unit of a man's wealth is practically soluble very far out, and so it is better to try to average the important items of wealth. Any single thing, such as land, *could theoretically* furnish a just base of all taxes. The practical difficulty with the land single tax is in determining just who owns or controls or uses a given bit of land (e. g., as one of thousands of equally difficult questions:- How much use does an aviation company make of the land it flies over; or may it drop monkey-wrenches anywhere free of charge?). That probable solution of this quantitative problem of the base of taxation is opposite that of the base of money (§168h); for it easy to determine the actual controller of a given piece of actual money. —— And obviously, the foregoing general theory of taxation fits with the actual general *practice* in this country (except that we are a bit vague yet about putting a profiteer or financial aristocrat in jail if need be). So it would be intelligent, and save much money, to enunciate and practice those simple principles openly.

[176d] Those remarks on *taxation*, and the more explicit remarks in par. g below on tariffs, are true only in rigorous theory. As will implicitly appear, customary methods of indirect taxation more or less correct conventional errors in principles of taxation; and such practical balancing is of course correct. —— The orthodox theory of taxation is that taxes are "a self-levied contribution which each man pays according to his ability" (Hadley, "Economics," §498) so that it becomes an unsolved question "whether we should try to tax the strong man at a relatively higher rate than the weak man" (ibid, §517). Thus it appears that the orthodox theory is uncertain; but that there is a general view that in strict justice all men should pay an equal fraction of what they receive, although orthodoxly, in practice perhaps it is better to tend towards having the poor or weak man

get repaid for a time. So obviously, any world state will have to be made largely on *credit* (*T*), by the able men who can work now for a benefit in the future—just as most large businesses are made. There would perhaps be an immediate "spiritual" return in some dropping of the tension of national distrust and refusal of credit (which distrust is concretely shown in expensive armaments); but many people are too defective nervously to see that (especially some armament makers who are quite similar in every way to liquor dealers; §166h). And it is certain that some men will betray that trust: the aristocrat we have always with us. If a nation in the world state betrayed the trust we could not put it in jail or an insane asylum; and the milder equivalent, ostracism or boycott, might not work; then we would have to kill it off more or less—perhaps a more unpleasant and expensive business than not having such a world-state obligation.

e. As we have seen, democracy is a conscious effort to approach a balance, and truistically if successful prevents war—which is the social surgery needed to cure an unbalance which is bad (§149n)—the attempted *cure* for hell. When the pain of an unbalance becomes great, the nation with the weaker nervous system becomes maniacal first and starts the war. The nation that keeps on preparing for war more intensely than another nation *openly admits its fear of the other*; and such open indulgence in cowardice (footnote 170r) and babying of its "nerves" will truistically make it wear out its nervous systems, just as any coward who gives way to his fears gets panicky: and it finally starts a war as a welcome relief from that pain of fearing—often becoming so crazy with that pain that it sincerely fancies the other nation attacked first. Obviously, any aristocracy, in consistence with its pseudo principle of repulsing the other nation and grabbing from it "a place in the sun" and any other little thing, must keep piling up its "preparedness" as much as it can (thus, by the unavoidable laws of nature as just seen, giving way to cowardice and destroying itself). A democracy tries to approach the balance, but it recognizes the inevitable natural fact that always there must be a fringe of defective aristocrats at each end of society (§168 p); hence, democracy forms a police force large enough to take care of the probable number of aristocrats who will go insane enough to need watching or become violent. But as that police force is an admission by the democracy that its educative efforts have inevitably failed of perfect success, it will truistically try to reduce the force. And that being in accord with natural law, all other advantages follow:- the democracy does not become cowardly, or panicky; it saves expense; etc.

f. There are three sorts of extreme pacifists *in theory* (none in practice, as the theory is quite wrong and can't work):- autocrats or militarists, socialists, and religious objectors. (1) The theory of the autocrats or militarists is that they will prepare so thoroughly that they can or will lick the rest of the world, and thus there will be absolute peace. It doesn't work, as we just saw, but it does superficially sound nice enough to delude those extremely pacific militarists. (Another pet delusion of those queer pacifists is that "preparedness" is national insurance. Insurance is distribution of a risk over *L* and *T*. The risk of war is naturally distributed over the whole nation, so it is merely silly to talk of distributing it further. And as regards *T* distribution:- instead of storing up wealth, as insurance premiums, to pay for war when some other extreme pacifists become violent, they spend it on "preparedness," and then have to get more out of an impoverished nation. But a police force is, intelligently, an admitted expense—what it costs a democracy for its failure to teach extreme pacifists to think.) (2) The socialists in theory are extreme pacifists in that they would have everybody an official of a single world government, so that there would be absolute peace because there would be nobody to fight. Incidentally, they in practice will first wage a war of extermination on those who disagree. (3) The first two extreme pacifists claim they want absolute peace, and are willing to fight for it. The third sort is the religious objectors who are going to get absolute peace by refusing to fight. Obviously, their "religious scruples" amount to trying absolutely to confuse the One and the Many; also, they deny that anything can be intolerable and they thus practically deny the One or religion (§169d), and force sane men to restrain them or kill them—which is war, merely under its zero name. —— So the difference between the aristocratic preparedness and the democratic preparedness is this:- the aristocrat has a fake panacea for war (in three guises) that actually produces or is an unbalance or disease for which war is one *cure*; so they consider it admirable to *increase* their "panacea" or armament: democratic preparedness recognizes that war is a last (or surgical) cure for a bad disease, a definite admission of democracy's imperfection and hence an armament or police force that we want to keep as low as possible. The aristocrat boasts of his preparedness, and flaunts it in the face of the world: the democrat regrets the need of his preparedness, but tries to keep it adequate to deal with the probable number of rather crazy aristocrats. —— A genius with words can do the race an enormous service by inventing good distinctive names for the two things:- democratic preparedness and aristocratic preparedness.

g. The next general quantitative result of a world state, or partial trial at one, is that it tends *towards* an economic balance, and so repudiates commercial exploiting or repulsions. In short, as is definitely recognized in effect by the Constitution (Art. I, §X, 2), any tariffs or imposts, or duties on imports or exports, between the parts of a democracy tend to disrupt it and destroy life, and so are immoral and explicitly forbidden. As a truism there must be free trade (even though there is no formal world state) *if* we are to be moral in our economic relations with other nations: the instinctive conclusion of mankind is glaringly to that effect, as is proved by the fact that at no time in history has appreciable moral stigma attached to smuggling. —— A tariff for revenue only is an obvious logical self-contradiction, and so spoils the brains of those who try to "believe" it:- for it truistically by the infinite regress protects some industries. Also, a tariff that is merely thus largely for revenue is an indirect tax, and immoral on that ground. —— If "infant" industries need to be protected for a time (and they practically do, as will implicitly appear), a direct bounty is obviously the open, non-secret, moral procedure. But that protection of infant industries is moral only temporarily; it is immoral and parasitical for anyone to accept aid long, just as it is for a grown child to live on his parents—and as unlovely. (I have heard of "key" industries: any argument for continued protection for such is merely the wailing of a spoiled baby lacking in resourcefulness and self-reliance; for rigorously, no industry or part of the Many can be absolutely essential or changeless.) In the long run, if you are unable to get better or-and more work delivered to you for a given price from me, than you can from any other laborer on earth, then truistically that laborer ought to do it for you:- for I am not of superior clay that you should take poorer work from me. You might *today* take my poorer work, *if* you thought that I would thus learn, and tomorrow give you so much better work than anybody else that you thus gained in the long run (that shows how a bounty for infant industry is right, just as it is economically right to support a child—and a volume of details on the two subjects is omitted:- e. g., the *parents*

ordinarily get their money repayment for supporting a child directly from society at the time [not later from the child], the care of the child increasing their earning capacity). In the long run you are immorally wasting human life if you do not buy in the best market:- your life, the life of the better laborer, and that of the poorer by making him a privileged aristocratic parasite. So the intelligent, democratic way is obviously to stop putting up those immoral tariff barriers to the best market. We shall usually prefer to react with those closer to us if they actually prove themselves to be friends by giving us good work (they have the economic advantage under normal conditions of being at less expense for transportation, and our inspection of the goods). But if a "heathen" in the other hemisphere can prove himself the better man by overcoming that natural economic handicap, then he is a better friend than the slack, incompetent workman next door. —— The biological and other human ways in which poor workmen get the job in an aristocracy and then pay for their "privilege" are these:- They verbally tell the aristocratic, fiat ruler that they depend on his *protecting* them, and standing for their poor work; they thus acknowledge that the aristocrat is superior, and that they (all tariff-protected business men who approve the tariff and all union-protected workmen who approve making the *employer* pay regular pay for poor work) are rather worthless, and they thus confirm the aristocrat in his power-madness *at the expense of degrading themselves mentally*—it is the road to uselessness. The aristocrat is similarly debased by that self-abasing, incompetent, and lying adulation, and his business is always really in an unhealthy, running-down condition. The good business man obviously can not afford to be tariff-protected, as it makes him soft and flabby, and wastes his time running to Washington with whines that not even a self-reliant baby would emit, and worst of all it costs him the public's good will. And in precisely the same way the labor unions can not afford their aristocratic game of protecting incompetents.

h. The last general quantitative result of a world state, or partial one, which I shall consider explicitly is the racial one. Because of the comparative difficulty of transportation and communication in past ages, various races have stayed rather steadily in somewhat different environments (climates) and truistically have lived at different rates, and so are now biologically different in a way which can most intelligibly be expressed as different virtual ages. The difference is so slight as not to cause mutual sterility (no doubt such sterility occurred in the past, and by the principles of periodicity nature promptly eliminated the weaker), and to make it unprofitable to give specific comparison here of such ages. Truistically intermarriage of those races produces a biological unbalance, just as the children of a couple of the same race wide apart in age are noticeably variable. Some of those half-breeds have little survival strength; a few are a mixture which is better than either parent stock (and of such half-breeds we spring). We have almost no knowledge of what crosses are good in the long run: it truistically clearly is silly to say that we imperatively must preserve racial "purity." And equally clearly and truistically one race is not essentially superior to another—merely quantitatively different. Truistically, if we force races to refrain from intermarriage, that increases the difference, until inevitably the unbalance will precipitate a race war in which one race is exterminated—and the advocate of race purity has no real facts to show that it won't be *his* race to go (I cheerfully agree that I have the usual human belief that it wouldn't be *my* race; and that I like my racial qualities and wouldn't care to take a chance on mixing them; but that is merely healthy emotion, and I retain, or have got, sense enough to know that I am ignorant of actual facts—and I have read Madison Grant's "Passing of the Great Race," and a lot of other such cheap, dualistic guesses.) So a democratic state will, just as the Constitution does, take races as essentially equal but quantitatively unequal, and will let alone (§149m) the question of intermarriage until there are some more-definite facts. It will be grateful to the persons whose strength or foolhardiness or environment forces a crossing, for having furnished data. *If* we decide that we must not cross with a certain race, that means that we will exterminate them—or become hypocrites and *be* exterminated.

i. Connected with that is the problem of birth control. The United States has over 35 inhabitants to the square mile —nearly 20 acres or ordinary city "blocks" to each person. If present knowledge were intelligently and vigorously used our land might be made to support 20 times that number. But practically, every increase of population causes some unbalancing which is often perceptible. Aristocrats hold that unbalances should be increased, and consistently with that they often explicitly want the birth rate increased—ordinarily the more aristocratic, militaristic, and imperialistic a person is, the more he objects to what he calls race suicide. (That phrase "race suicide" is scarcely rational:- if I avoid getting fat I do not commit suicide, and a race that avoids overgrowth does not; the phrase is stupidly used by aristocrats to beg the question as to actual facts.) The upper ten aristocrats of course want more people to lord it over and use as cannon fodder. And the submerged tenth aristocrats breed like nearly thoughtless rabbits. Neither have enough intelligence to understand democracy or temperance, but again in this case proceed on the pseudo principle that an unbalance is desirable—that if a little is good, more is better. Some few couples are geniuses at producing say as many as ten vigorous, useful children: but the ordinary family with five nowadays is a calamity to the state and early death to that parent who takes the responsibility seriously. In the old days large families were worse on both children and parents; but in those days people were so stupid that the majority blundered into an accidental death before thirty, so that quantity was then of more importance. Democracy requires a balanced degree of racial increase. Perhaps we are up to the point in our history where the great and useful pioneering will be in quest of quality, to restore and if possible maintain the balance *Quantity*...$\times$*Quality*.... That pioneering has already been begun as regards the race itself by the average person in this country—which birth control is probably the most important symptom of our sound social health. The pioneering in business ethics—the intelligent building-up and seeking of "good will"—is perhaps the next.

j. So it appears that a consciously formed world state will not necessarily end war. Any severe climatic variation is likely to cause war—and would, unless men were agile enough mentally to meet the change rapidly with appropriate balancing of *Unselfishness*...$\times$*Selfishness*.... A world democracy based on the sound principles of the Constitution will ordinarily prevent disturbances of much size—will ordinarily prevent a "war." The chief danger will be the same as always in the past:- a power-mad, selfish boss and citizens too unintelligent to size him up and to see where they will land if they follow him a little way on his primrose path to sudden glory and wealth. There is no automatic way to end war: it all depends on men in the end. Wars cure the worst unbalances by weeding out the worst aristocrats—and a new crop starts at once. A knowledge and use of democracy can keep the aristocrats from growing, by education if that is done well enough. And that is work. —— When we get out of balance with the *environment* there is in effect a "natural" war called famine or-and pestilence. Democracy

involves keeping a tolerable balance with the environment (cf. footnote 175e). Part of that is called maintaining the standard of living; and roughly, in business the 'standard of living' is called overhead. The aristocrat dualistically fancies that such standard (including various heavy business expenditures for costly stationery and palatial furnishings, etc.) is a sacrosanct affair that must be maintained of itself. But an intelligent child can see that if that standard and overhead does not enable its possessor to react better, with both material and men, and thus do better than any "cheap foreign labor," then that expense is in some degree a waste —a destructive evil instead of a good.

§177. a. Thus any democratic state involves us in quantitative problems impossible of accurate solution, with grave perils on each side of the balance. That is what life is: we like it. Everything in the universe is engaged in the same sort of balancing, and in time wears out and changes into a different order structure, just as we all die—thus being a part of keeping the perfect balance of the whole.

b. The race has for ages been increasing its life or happiness—extending its limits of conscious balance with the environment, and becoming more consciously God. Thus the race has grasped and enjoys the universe in a rough way, and has grasped the "material" earth in a rather definite way; and has already substantially formed a more or less organized world state, thus also grasping its human members in a rather definite way. Most of the race enjoy braving and balancing the dangers at those two limits or outer zones—and thrive on them, even though those dangers sound objectionable when explicitly described as in the last section. The spreading of the limits of consciousness into those dangers is an increase of the definiteness of relationship—of love. Because the race is as a verifiable fact now consciously related to a wide extent, we as a truism of that fact love the race unless we are defective. But there are a few of the race who get out into those danger zones and are so weak as to be damaged and be unable to get back to a balance, or see that they want to. They are the aristocrats—the submerged tenth on and as one dying fringe or breaking-up difference surface of the race, and the upper ten on the opposite fringe. Those fringes are where the consciousness of relationship or love begins to dim. But in a wide sense we see we love those failing and quitting aristocrats as being inevitable in the nature of things, and as interesting and entertaining horrible educative examples.

c. And that generally satisfactory condition of human affairs, with always some perceptible unbalances that are on the way to a balance if we take enough time into view, outlines what we have seen in this book. The book is a description of the universe, given chiefly in terms of humans because those are familiar and intelligible. It is a rigorous unification of the universe, because that infinite universe *is* our ultimate selves—we being God in that religious aspect. That unification is expressed as the solution of the One and Many. The race for centuries has tacitly been using that solution or logic—knowing the principles and applying them to the objective world as science, and to ourselves as morality or democracy.

d. The essentials may be briefly stated, although it required a number of pages to make them positively evident:- The One is the Many. We grasp and are the One by working personally with the Many in a temperate or democratic way. From the point of view of our feelings or sense of well-being that balanced rhythmic grasp of the One is happiness; from the point of view of our seeing or knowing or intellect that balanced rhythmic grasp of the One is ineffable beauty.

APPENDIX A

ABBREVIATIONS

No attempt is made to include ordinary abbreviations, or to include those used in short passages wherein they are first explained (in several such cases abbreviations are used in a sense different from that listed below as their usual meaning).

"Ency. Brit." "The Encyclopaedia Brittanica," 11th ed.
Daniell's "Physics." Alfred Daniell, "A Text Book of the Principles of Physics," 3rd ed. (1902).
Marshall's "Economics." Alfred Marshall, "Principles of Economics," 6th ed. (1910).
Watson's "Physics." W. Watson, "A Text-book of Physics," 5th impression (1904).
Wood's "Optics." Robert W. Wood, "Physical Optics," 1st ed. (1904).

Subscripts that are used in the text with several of the abbreviations below, are given separately.

A (1) a general symbol for any given thing; (2) chemical affinity, or intensive factor of dynamic molar energy.
C variable numerical coefficient for molar or static masses.
Ent entropy, or extensive factor in heat energy.
Energy energy.
F force.
G variable numerical coefficient of 'dynamic' or gravitation masses; also sometimes used, as indicated by context, as the conventional gravity *constant*.
H variable numerical coefficient for 'dynamic' heat; also used, as indicated by context, as orthodox heat *constant*.
J variable numerical coefficient of 'static' heat: also used, as indicated by context, as *constant* Joule's equivalent.
K variable numerical coefficient of 'static' electricity; also used, as indicated by context, as the conventional *constant* specific inductive capacity.
L length or space—one unit measure of length.
M mass—specifically, one unit or part of the universe.
P potential of electricity or intensive factor of elec. energy.
Q quantity of electricity or extensive factor of elec. energy.
R a conventional *constant* used in heat.
T time—one unit measure of time.
Temp temperature, or intensive factor of heat energy.
That that; anything, as compared with a *This*.
This this; any given thing.
U variable numerical coefficient of 'dynamic' electricity; also used, as indicated by context, as the conventional *constant* permeability.
V velocity.
V_1 average velocity of light in a "vacuum" in our neighborhood. See §126b for other subscripts.
W weight.
c (1) current of electricity; (2) see §82a.
d (1) distance, same as *L*; (2) differential symbol.

Continued on Next Page

e [subscript] zero or standard formal unit (§71b).
l length, same as L.
m unit magnet pole.
m [subscript] dynamic.
n any number.
p pressure.
r radius, same as L.
r [subscript] indicates a relationship word.
s [subscript] static.
v volume.
... indicates infinite regress (§33g).

APPENDIX B

PERIODIC TABLE OF ELEMENTS

1 H
1.008

o	I	II	III	IV	V	VI	VII	VIII		
2 He 3.99	3 Li 6.94	4 Be 9.1	5 B 11.0	6 C 12.00	7 N 14.01	8 O 16.00	9 F 19.0			
10 Ne 20.2	11 Na 23.00	12 Mg 24.32	13 Al 27.1	14 Si 28.3	15 P 31.04	16 S 32.06	17 Cl 35.46			
18 A *39.88*	19 K *39.10*	20 Ca 40.07	21 Sc 44.1	22 Ti 48.1	23 V 51.0	24 Cr 52.0	25 Mn 54.93	26 Fe 55.84	27 Co *58.97*	28 Ni *58.68*
....	29 Cu 63.57	30 Zn 65.37	31 Ga 69.9	32 Ge 72.5	33 As 74.96	34 Se 79.2	35 Br 79.92			
36 Kr 82.92	37 Rb 85.45	38 Sr 87.63	39 Y 88.7	40 Zr 90.6	41 Nb 93.5	42 Mo 96.0	43 —	44 Ru 101.7	45 Rh 102.9	46 Pd 106.7
....	47 Ag 107.88	48 Cd 112.40	49 In 114.8	50 Sn 118.7	51 Sb 120.2	52 Te *127.5*	53 I *126.92*			
54 X 130.2	55 Cs 132.81	56 Ba 137.37	57 La 139.0	58 Ce 140.25	59 Pr 140.6	60 Nd 144.3	61–62 Sm 150.4	63 Eu 152	64 Gd 157.3	65 Tb 159.2 66 Ds 162.5
67 Ho 163.5	68 Er 167.7	69 Tu 168.5	70 Yb 173.5	71 Lu 175.0	72—	73 Ta 181.5	74 W 184.0	75—	76 Os 190.9	77 Ir 193.1 78 Pt 195.2
....	79 Au 197.2	80 Hg 200.6	81 Tl 204.0	82 Pb 207.20	83 Bi 208.0	84 Po (210.0)	85—			
86 Em (222.0)	87—	88 Ra 226.0	89 Ac (227)	90 Th 232.15	UrX_2 (234)	92 Ur 238.2	....			

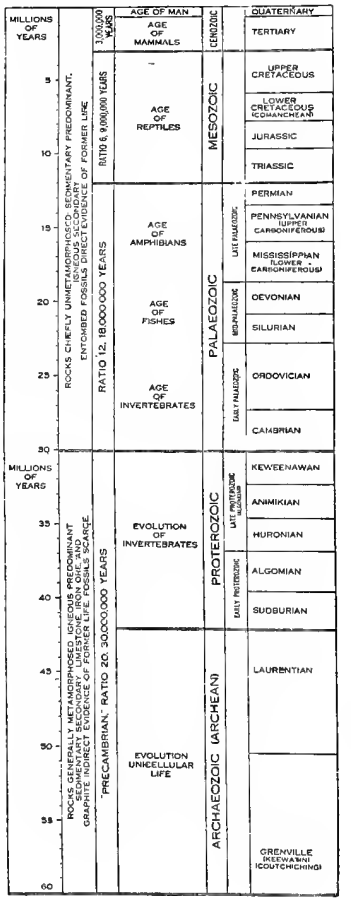
This periodic table of elements and their atomic numbers is adapted from Millikan's, "The Electron," published in 1917. The weights of elements not in the order of their atomic numbers are in italics.

1 Hydrogen
2 Helium
3 Lithium
4 Beryllium
5 Boron
6 Carbon
7 Nitrogen
8 Oxygen
9 Fluorine
10 Neon
11 Sodium
12 Magnesium
13 Aluminium
14 Silicon
15 Phosphorus
16 Sulphur
17 Chlorine
18 Argon
19 Potassium
20 Caleium
21 Scandium
22 Titanium
23 Vanadium
24 Chromium
25 Manganese
26 Iron
27 Cobalt
28 Nickel
29 Copper
30 Zinc
31 Gallium
32 Germanium
33 Arsenic
34 Selenium
35 Bromine
36 Krypton
37 Rubidium
38 Strontium
39 Yttrium
40 Zirconium
41 Niobium
42 Molybdenum
43 ——
44 Rhuthenium
45 Rhodium
46 Palladium
47 Silver
48 Cadmium
49 Indium
50 Tin
51 Antimony
52 Tellurium
53 Iodine
54 Xenon
55 Caesium
56 Barium
57 Lanthanum
58 Cerium
59 Praseodymium
60 Neodymium
61 ——
62 Samarium
63 Europium
64 Gadolinium
65 Terbium
66 Dyprosium
67 Holmium
68 Erbium
69 Thulium
70 Ytterbium
71 Lutecium
72 ——
73 Tantalum
74 Tungsten
75 ——
76 Osmium
77 Iridium
78 Platinum
79 Gold
80 Mercury
81 Thallium
82 Lead
83 Bismuth
84 Polonium
85 ——
86 Emanation
87 ——
88 Radium
89 Aetinium
90 Thorium
91 Uranium X_2
92 Uranium

APPENDIX C

GEOLOGIC TIME SCALE

Prepared by H. F. Osborn and by C. A. Reeds after Schuchert. Reproduced from Osborn's "Origin and Evolution of Life." *The times given are much too short* (§112hi; XII).



INDEX

How to Use.

'48b' refers to section and paragraph; 'f48b,' to footnote; 'Fb,' to section and paragraph in Preface; 'One,' to Part One; 'ii,' to page ii in Introductions; 'IX,' to Chap. IX.

This Index is not full. The names of persons are not always the actual legal names; the names of subjects are not always the actual names used in the text. The Index is a compromise, with no special consistency except in an attempted ready usefulness. It is not satisfactory to me, except in that it is the best I could do in a reasonable time. In theory it should be less so to the reader.